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EDITORIAL NOTES.

Existence Justified.

IN the absence, on active service, of the President of the Society of British Gas Industries (Sir Alfred Keogh, K.C.B., LL.D., M.D., the Principal of the Imperial College of Science and Technology), Alderman F. Templer Depree, Chairman of the Council, delivered an address at the annual meeting on Thursday last. In the main, the address was composed of a review of the history of the Society. It is good to make an examination of the aggregate constituents of a record of the kind, in order to pass fair judgment as to whether existence has been fully justified. If the result of the examination is proof of value, then criticism is at once disarmed. Looking carefully through Mr. Depree's digest of the history of the organization, it can be truly said that it has proved its value as a fit and usefully affluent body, and that it has interwoven itself inseparably into the political affairs of the gas industry, and is now indispensable to its progressive work. It is especially gratifying to us to be able to write this, not alone on our own judgment, but on that of independent observers, after the passing of a decade since—on Dec. 6, 1904—we suggested in the "JOURNAL" columns the desirability of forming an organization of the contractors and manufacturers associated with the work of the gas industry.

It seems rather ludicrous now, with before us the very substantial service rendered by the Society to the gas industry in its co-operative work and in other ways, to recall the croakings of a few who ten years ago were filled with dread lest such an organization should be the breeding-place of all sorts of mischief. The rebuff has been complete that actual event and result have given to those timid ones, who seemed to think that the plant and appliance manufacturers connected with the gas industry could not possibly have the same ideals as themselves, nor could conduct an organization with the view to making it industrially useful. Mr. Depree himself says that the idea "seemed revolu-"tionary at the time; but we now know it was very sound." We cannot divine why an organization should even have "seemed" revolutionary at the time. It appeared to us then to be quite a natural thing that the contracting and manufacturing units of the gas industry should be brought together for effective service, just as the gas engineers had been; and that this was the natural, and therefore the correct, order of things, the result has more than confirmed. Mr. Depree vaguely refers to some difficulties with the Press in regard to the Society. There were never any difficulties so far as the "JOURNAL" was concerned. It was consistently believed by us that our advocacy in 1904 was right; and we were not then prepared to turn upon that which flowing time has more than proved to have been the correct policy, and which policy has been endorsed by a line of distinguished Presidents holding the very foremost positions in the scientific and the professional worlds. The Society has drawn tighter the bonds between the whole of the parts of the industry; and it has provided the avenue for co-operative work. It is not too much to say it was the one thing necessary to pre-existing organization to make possible the British Commercial Gas Association on the widespread scale on which it now exists. The growth of the Society itself has been magnificent; and it is now, as it has been for some years, thoroughly representative of the manufacturing and contracting sides of the industry. It has been managed with exemplary business capacity; and the past guarantees the future. More need not be said, because in the making of the history of organized effort in the gas industry over the last decade, the Society has taken a hand which has not been overlooked and cannot be forgotten.

For the rest, Mr. Depree's address shows his satisfaction with the progress of the industry on both its manufacturing and gas-using sides. Among the triumphs which have particularly arrested his attention during the past decade have been the vertical retort system, high-pressure lighting, and the increased application of gas to domestic and industrial service, including water-heating. The demands upon the industry grow. From its residuals, the intermediate products for dye-stuffs are required, and so are essentials to the production of high explosives. From Mr. Depree's standpoint, the outlook for extended service of the industry is great and promising; and that is what all observant men see. Progress for the time being is stemmed by external reasons. But the universal hope is that we may emerge from the present dismal situation with all possible speed, consistent with a definite clearing-up of the great issues in the name of humanity and the causes of lasting peace and civilization. On that emerging, the commercial progress of the gas industry will be resumed.

Gas Fuel in War Time—and Always.

THE gas industry may pride itself upon the special service it is in the present rendering to the country, to its Allies, and to the causes of peace and civilization, but of which service the outer world knows little. Not only in the provision of the substances for the making of explosives, but in other ways, the industry in these critical days has been helping—silently, yet actively, and with very material result. The interests of the country and of the gas industry have always been of a mutual order; but they are more so to-day than ever. From some of the work that has been lately accomplished, without fuss, but with alacrity and an abundant success, Mr. H. M. Thornton (the Vice-Chairman of the Richmond Gas Stove and Meter Company) partially withdrew the screen at the meeting of the Royal Society of Arts last Wednesday, in the course of a paper on the industrial uses of gas. The paper interested and instructed an audience that crowded the lecture theatre, and sent its members home well stocked with information as to the indispensability and potentiality of gas in industry always, and more especially at the present time, when the efficiency which produces at once a smart return in output and of the very highest possible quality is a condition of vital importance to our success and that of our Allies in the greatest struggle in the world's history. The paper was unpretentious, and so was the author; but this very characteristic threw into relief the importance of the subject to country, industry generally, and to the undertakings supplying gas. There was also on the part of the author complete detachment throughout from all trade association, and generalization stamped the entire composition. There is no reason to doubt that Mr. Thornton, or rather his firm, hopes to share in the fruit of the educational work that the results of his study of this immense subject of the application of gas to industrial operations has enabled him to carry on; but the work has been prosecuted in a manner in which self-interest has been completely effaced and the general good kept in the ascendant. Recognition of this is due to the author.

The audience—part technically trained, and part representatives of the public with an interest in art and industrial progress—listened first to the case presented by Mr. Thornton against the waste that heating by coal in manufacture produces, against the uneconomy that such use means from beginning to end, and against its ill-effects in the matter of air pollution. There followed, on the lantern screen, a remarkable succession of photographic reproductions, showing illustratively, but not by any means comprehensively, the already widespread applications of gas in industrial operations—each picture being accompanied by an explicit explanatory statement, so far as the prohibition against the divulging of secrets did not restrain the author. Three important points emerge from this collection of illustration and explanation. The first is that gas has already a greater hold in industrial heating than most people are yet cognizant of—even many people in the gas industry. The second point is the extraordinary development of the uses

of gas in manufacture—one successful application almost unfailingly leading to others; and so the territory for fresh business connection between the suppliers of gaseous fuel and the manufacturers of the country has never-ending expansion. The third point is how great an asset to the country in the great emergency has been a plentiful supply of gas, readily applicable, and ever manageable for all classes of work. But while we take much credit for gas in this matter, there ought not to be oversight of the part that the makers of gas furnaces and other appliances have taken in responding to the large demand that came upon them with the same swiftness that war came upon the country. In this connection, too, the fact that the manufacturers turned to gas as the best means of enabling them to comply with the demands of the Military and Naval Authorities for equipment for the new Army and Naval units, and for the constant supply of ammunition, in ever-increasing quantities, of all grades, is proof of the efficiency of the gas-heating educational methods pursued in industrial places during recent years. The adaptability of gas in heating, the promptitude with which its installation can be effected, the quickness with which factories have been transformed through it from the industrial occupation of peace times to centres of great activity in the production of munitions of war, the flexibility of the gaseous means of heating in relation to work—from work associated with the making of the peaks of soldiers' caps and the buttons for their coats onwards to the manufacture of the largest shells and the production of immense ordnance—have been separately and collectively proved in such a manner that henceforth there can be no disestablishment of the position of gas in industry. But given this heating process—quickly installed, applied, and worked, with its great range of temperature regulation for any purpose—given, too, the material for the production of what is required, a huge responsibility rests upon masters and men in industry to see that all the needs of the nation and its Allies are met with requisite fulness. That they can be so met is certain.

The paper by Mr. Thornton gives an indication of how greatly the war has enlarged the sphere and opportunities of gas in industry. When we emerge victorious, with our Allies, from the terrific and appalling conflict, it may be that the part that gas has taken, and is taking, in the rapid provision of the munitions of war will fade from memory. But among the minor victories associated with the war which will remain continuously in evidence will be that of rational, work-speeding, cleanly gaseous fuel over crude and value-dissipating methods of heating. This subsidiary victory will stand as an inestimable advantage for all time to the community, to manufacturing interests, as well as to the industries supplying gas and gas-consuming furnaces and other appliances.

Capturing and Keeping Export Trade in Sulphate of Ammonia.

With all good intentions, Mr. R. J. Milbourne read a paper, at the meeting of the Society of British Gas Industries last Thursday, on "A Trade that Might be British." It was an excellent paper; and in the collecting of the facts and the preparation of the accompanying curves, the author had put in some very careful work. The only excuse, however, that we can find for the reading of the paper before the Society is that Mr. Milbourne had not a more suitable platform before an Association identified with the gas-supply industry, which instances the narrowness (distasteful to broad-minded men) that exists and rules in our very midst. Still the platform having been provided by the Society, the paper will obtain a wider circulation through our columns; and the philosophic utterances and deductions may fall where they will be of the greatest value in producing the desired result. The members of the Society are not producers of sulphate of ammonia; and it is the German overseas trade in this commodity which Mr. Milbourne thinks "might be British." How it is to be made and to be kept British, depends on circumstances; and therein is the interest of the members of the Society, because anything that means the promotion of the business of the gas-supply industry, and the making of it more profitable, inures to their own prosperity. The contrary conditions produce contrary effects. Though not producers of sulphate of ammonia, some of the members are makers of the plant required for its manufacture; and the plant plays a not unimportant part in working efficiency and quality of produce. And quality is in the future going to have a noticeable bearing upon the overseas trade.

Before dealing particularly with the essentials to the capturing of new, and the maintaining of the overseas trade in sulphate of ammonia in future, there are a few matters of a general character that find appropriate place in the paper. It goes without saying that it should be the ambition of every individual making his income in whole or in part, directly or indirectly, from the gas industry to desire to do what in him lies to develop the business generally of the industry. But when it comes to taking up new trade owing to Germany's present disability, then we are dealing with a matter in regard to which it is no use jumping precipitately to conclusions. There must be careful investigation as to what new trade can be profitably absorbed; and in this connection there is no impropriety in learning even from an enemy. It is only by systematic and incessant work that Germany, without any great obtrusiveness until firmly established, pushed its way into all the markets of the world and in almost every line of business, and placed a controlling hand over many businesses which "might" have been British, if ——. The blank can be filled in several ways; and if there is a little contempt put into the "filling" for this country's lethargy and shortsightedness, it will not be unwarrantably disrespectful to ourselves as a nation.

We look around; and there is seen German entry and occupation in almost every trade. The author of the paper quotes ways in which the members of the Society have been affected. There has been, he remarks, competition of German coal for gas-making in this country; but the fact is that only a few trial lots have been brought here. On the other hand, there have been German purchases of British colliery properties in this country; and German colonies have sprung up around them. German fire-clay goods have been used fairly extensively in this country; and for some time German spigot-and-socket pipes have been in competition with the produce of the home foundries. The threatened invasion of German gasholders has not been consummated. As against this menace, certain gasholder firms, and other members of the "heavy" section of the Society, have booked and executed some considerable orders on the Continent, but not to any large extent in Germany. Mr. Milbourne omitted from his compendium the field in which the enemy countries have cultivated business in the gas industry to the largest extent—that of gas-fittings, glassware, and mantles. In regard to the last-named, the clever capture of the monazite sand, and therefore of the nitrate of thorium supply, is an instance of Teutonic cuteness and foresight, and of the value placed upon a monopolizing control of sources of supply. We sympathize with, and accept without demur, Mr. Milbourne's contention that it is not in the best interests of British gas undertakings that they should always purchase their requirements in the cheapest markets. The rules reproduced in the paper, for securing the loyalty of Germans to the commercial interests of the Fatherland may for many Britishers have quite a humorous smack about them; but if there is, and we believe there is, a faithful observance of them not only in Germany, but in all parts of the world where Germans are to be found, the result would be anything but an insignificant one. If we of the gas industry pursued the principles laid down in these rules, it would be of advantage not only to the industry, but to the country—that is to say, so long as patronage abroad was not necessary as a protection against any unfairness at home, and as a mitigant of excess. Admittedly there is inequality in the competition with Germany at ordinary times—an inequality made up of a number of effective factors on the part of astute Germany; and this we ought not to forget when considering our own manufacturers.

Turning, however, to sulphate of ammonia. What are the conditions for consideration? To summarize them: Our own production—we are speaking of normal, and not war, times—is increasing; and so is Germany's. And not only from coke-oven and gas-works plants, but largely also through the production of what is known as synthetic ammonia, with the nitrogen obtained from the atmosphere. There is the new production, too, of an ammonia fertilizer from water-power derived cyanamide. Our export trade with Germany has been on the decline, with slight fluctuations. Germany has been unable to internally absorb its entire production of sulphate of ammonia, and so has become a keen competitor for the overseas trade. The production in Germany of synthetic ammonia will continue to grow; and there is not the slightest doubt we shall, after the war

see the amount of sulphate of ammonia available for export from Germany greatly enlarged. Furthermore, Germany has already shown her hand as to how she intends to compete. Since active competition set in, the producers of that country have been supplying 25 per cent. ammonia, with a smaller percentage of free acid and moisture in it, at a lower price than we have been selling a 24 per cent. material. But from the fact that we have been able to do this, together with the one pointed out by Mr. Milbourne—that during the last ten years our exports have been gradually ascending—it must not be deduced that we are going to continue to come out on top by following the old ways. Germany's methods are not going to stop, any more than is its volume of sulphate of ammonia production; and sentiment is not going to prevail over commercial laws for all time—especially overseas. Germany began to set the pace in these markets before the war; and any disinclination to follow and equal could only have but one effect, and that a fatal one, for British producers. We have to provide what buyers want; not what we are disposed to give. Lower prices and higher quality are part of the commercial strategy adopted by Germany in building up new markets, and in cutting-out established possessors of markets abroad. This position must, of course, be looked at fairly and squarely, without talk of 24 per cent. sulphate being less costly to produce than 25 per cent., and thus capable of being sold at a lower figure. If we shirk dealing with the facts, then we shall find ourselves not only incapable—assuming the sufficiency of our production—of permanently capturing the Germans' £700,000 export business in sulphate of ammonia (which will be an increasing quantity in future, if we cannot successfully keep the competition in restraint), but we shall lose a large part of the business that we have.

It is for the gas industry a highly important matter to which Mr. Milbourne directs attention. The most has to be made of the present friendliness of the world towards this country. Our customers' wishes as to the quality of the particular commodity under consideration have to be met; and, when the war is over, there will have to be a careful watch maintained over movements by Germany towards re-establishing trade, as well as over prices. The grip of competition will again be felt. While nearly the whole overseas trade in sulphate of ammonia may be made British for a time, it will depend upon the policy, present and future, of the producers of this country whether there will be British continuity in holding that trade. This policy, it may be emphatically said, can only be framed, and given full effect to, through organization. Mr. Milbourne missed in his advice to plant makers and sulphate of ammonia manufacturers one important consideration, and that is the necessity of universal support being given to the Sulphate of Ammonia Association.

Price of Gas and Sea Carriage of Coal.

Reference was made in last week's issue to the increase to 3s. of the price of gas by the Gas Light and Coke Company; making a total advance since the war began of 6d. Allusion was also made to the premature announcement in the daily and weekly Press of a further increase by the South Metropolitan Gas Company; and it was intimated that the announcement, though premature, would probably prove to be but the shadow of a coming event, as it was obvious, in view of existing freightages and the higher cost of coal under coming contracts, that the Company could not go on with a price of 2s. 4d. The matter was considered by the Directors last Wednesday; and they then decided to raise the price to 2s. 10d.—making an increase of 8d. since the war started. This, of course, will carry with it an advance of price by the same amount in the area of the Gas Light and Coke Company south of the Thames. In the circular-letter to the consumers [reproduced elsewhere], the South Metropolitan Company rightly throw the blame for the extraordinary increase upon the Government, whose action in regard to charges for interned steamers has been a support to the profit-grabbing shipowners. However, the Company, who have been in the habit of chartering steamers for the conveyance of coal to London, now state their intention to, as soon as possible, "take the carrying of coal into their own hands by purchasing the necessary steamers." A large part of the coal supply of the Gas Light, Commercial, and Wandsworth Companies has for some time past been brought to London by their own boats. The South Metropolitan Company have, however, found that, all things considered, in normal times the chartering of vessels has financially served their purpose; but the war is going to bring them into line as shipowners with the other Companies. They are suffering heavily at the present time over the unprecedented and unexpected condition of things that rules in the matter of freightage between the Tyne and London; and so are those smaller Companies in the South depending on sea-borne coal, who are not in the position to purchase and run boats on their own account. Why should not the smaller companies amalgamate in dealing with this matter?

The Coal Miners' Share.

We like the spirit of the utterances of Mr. J. H. Thomas, M.P., at a meeting of railway men the other night. He was talking on the subject of labour disputes during the war, and said emphatically there ought not to be any question in dispute to-day that is not capable of adjustment. He further remarked: "Just as it is wrong for a rich man or a capitalist to take advantage of the nation's difficulty to make large profits, so it is equally wrong for the worker to take advantage of the same position to gain his own end." It is to be hoped the coal owners and miners of the country will be animated by the same spirit as that displayed by Mr. Thomas. The coalowners are among those who are taking advantage of the country's difficulties by raising the price of coal, beyond the additional costs to which they have been put by reason of the war; and now the coal miners—among the best paid men in the country—are putting forward a claim for a 20 per cent. bonus, on account of the increased cost of living owing to the war. The highest special advance to any class of workers, due to the present increased cost of living, that we have seen has been 3s. per week to those earning 30s. and under; and at the 30s. line, the 3s. is equal to 10 per cent. The miners unblushingly open their mouths wider than that; and they ask that their claim shall be immediately conceded, although legally they are not entitled to agitate for an advance until July next. But it is held by them that the present conditions are exceptional, and were not contemplated when the agreement was entered into, and that abnormal circumstances cancel such treaties. But while there are some bellicose trade union leaders who assert that the men would be quite justified in handing in their notices if the masters do not readily concede their demand, there are others who, like Mr. Thomas, think the matter can be amicably settled. We are not prepared to for a moment entertain the view that the unpatriotism already shown in the coal trade by the excessive raising of coal prices will be carried to the length of a rupture between owners and miners so as to produce a stoppage of work. Supplies in some fields are not so plentiful now as they might be if more time was worked by the men; and Lord Kitchener and Sir Richard Redmayne, the Chief Inspector of Mines, have appealed to the miners to shorten their Easter Holidays to one or at most two days, in order not to let supplies sink to a lower level still. It is hoped the appeal will find a hearty response.

The British Dye Scheme.

It looks as though, unless the Government step in and save the situation, the dye scheme which has been so long under vigorous discussion will fail from insufficient support. Seeing that support to the extent of upwards of 400,000 shares was previously promised (part on certain conditions), the result of the issue of the Company's prospectus is a very poor one. There were only 880 applicants for 571,000 shares out of the million offered, and 83,000 of these were only conditionally applied for. The subscribers have been invited to meet to-morrow, to discuss whether anything can be done to save the scheme and the assistance of the Government. There is no doubt whatever that the whole difficulty hinges on the question of protection; and, under the exceptional circumstances, the Government would find a considerable backing from their own side of the House to a secession, in connection with this scheme, from the principles of Free Trade. It is a case where special measures are required to meet a special situation; and many people who would subscribe capital to the scheme will not do so unless it is made impossible for the Germans to come here after the war, and render the capital valueless. The Government can, we believe, save the scheme, if only they will; and no one would, under the extraordinary circumstances, charge them with violating their own principles. If a way is not found, and adopted, for escaping

from the present *impasse*, the whole project will collapse; for, on the present subscription, the Directors of the Company do not feel justified in going to allotment. The position is a grave one for many industries; and every day lost is of importance to them and to the country generally. Are we to have in the matter of the provision of dyes and colours a permanent large increase of trade, or is Germany to remain in unchallenged possession of that trade? There will never be another opportunity like the present for carrying out what is necessary for the home-provisioning of this country in dyes and colours, and making it quite independent of Germany. It is a case of now or never.

A Gas Purchase Arbitration Award.

Porthcawl, a small seaside town in Glamorganshire, has "developed;" and with growing prosperity, the Urban District Council, as many local authorities have done before them, cast longing eyes upon the undertaking of the Gas Company. When the Company, in 1913, went to Parliament to secure an alteration in their status from a non-statutory undertaking to that of a statutory concern, provision was, by agreement, inserted in the Bill that if the Council went for a Purchase Act in the following session the Company should not oppose. In due course, the Council secured their Act, in which it was stipulated that no regard was to be had to the fact that the Company also had obtained one. In other words, the valuation was to be on the basis of a non-statutory concern. The matter thus far was comparatively speaking plain sailing; but when the arbitration proceedings took place, it was found that a number of points remained with respect to which there was ample room for difference of opinion. The extent of the difference, indeed, is shown by the fact that, whereas the expert witnesses who gave evidence on behalf of the Company arrived at a total value for the undertaking of over £52,000, those appearing for the Council thought a fair purchase price would be £21,000 odd. The Umpire was the Hon. J. D. Fitzgerald, K.C., who was, of course, able to bring to bear upon the arguments a long experience of such proceedings, though there was one point upon which no exact precedent existed to guide either him or any of those engaged in the case—namely, the abnormal position of the Money Market and its relation to investments. The importance of this question as bearing upon the valuation was shown by the amount of attention given to it throughout the hearing. Exactly at what point between the 25 years' and 16 years' purchase suggested by the respective parties the Umpire has fixed the price, must be left to calculation; but his figure of £30,396 is, it will be seen, much nearer the valuation of the Council than that of the Company. In fact, the Chairman of the Council stated that it was the figure at which the Council had advised the ratepayers that the works could be purchased; and the public received the award with cheers.

The Information of the "Building News."

A little knowledge is said to be dangerous; but it is often a pitiful thing to read newspaper comment and criticism upon a subject of which the writer has no knowledge whatever. In columns headed "*Currente Calamo*" in the "Building News," a writer on the subject of the increase in the price of gas in London lets his pen run beyond facts. He censures the Companies for having advanced the price, and thinks "the consumers will want better reasons for this action than have yet been formulated." We do not know what "better reasons" the consumers require than that which they have already had, and which was well put by Mr. D. Milne Watson, at the meeting of the Royal Society of Arts last Wednesday, when he said that, while the price of gas had only been put up 20 to 25 per cent., the increase in freightage on coal from the Tyne to London is about 300 per cent. Then the strangely misinformed "Building News" thinks that the "local authorities, with the hours of public lighting considerably reduced, will be anxious to know why they have had no reduction hitherto corresponding to the considerably *reduced freightage* on the diminished quantities of coal burnt [*sic*]." But as it happens they have had considerable allowances for unconsumed gas; while the electrical people—particularly where the electricity undertakings are owned by the Borough Councils—have demanded and obtained the full pound of flesh under their contracts. We do not know where diminished freightage comes in, when freights have been standing at a figure equal to an increase of 7d. to 8d. per 1000 cubic feet on the cost of gas produced from the coal carried at those rates. Our contemporary, in search of the true reason for the increase in the price of gas, fancies it must be due to the Gas Companies desiring to make the consumers pay for the vigorous publicity campaign of the past year or two. That is very silly; and its observation is equally so that it has not noticed, in provincial towns municipally supplied, any such additional heavy charges as have been placed upon the London consumers. Our contemporary had better ascertain whether those provincial towns are situated near the coal-fields, the distance coal has to be carried to the gas-works, whether it is railborne or seaborne, and get some definite figures as to costs of material delivered on to the works in comparison with the current costs of concerns in London and southwards.

Advice to Gas Consumers.

A contributor to the "Daily Express" last Saturday, calling himself "A Gas Engineer"—we should prefer to give him another title—in an article, under the heading of "Short-Circuiting a Gas-Meter," essays to show gas consumers how gas bills can be reduced without loss of light and boiling efficiency, in order to counterbalance the increased cost of gas. He says that "by the introduction of a little care into the methods of lighting and heating, it is quite possible to save at least the amount per annum by which the cost of gas is now increased, and probably a little more." We quite agree with him so far; and should have no cause for adverse criticism had he stopped there. It appears that, in the opinion of this so-called "Gas Engineer," it is the pressure of gas which causes consumers to pay more than there is any occasion for them to do, and that the remedy is in their own hands. If it is in their own hands now, when the price of gas has temporarily gone up abnormally through extraordinary causes, then it is in their own hands always. This particular "Gas Engineer" does not seem to have much faith in those controlling the industry from which—on paper at any rate—he professes to derive the wherewithal to keep body and soul together "It must be understood," he says, "that the gas company's concern is not to deliver to its customers gas at the pressure best suited for either light or heat, for, if such were the case, the troubles involved would turn the distributing engineer's hair grey in a week. This is why [that is, to save the hair of the distributing engineer turning grey] the gas comes to the consumer more often than not at a higher pressure than is really necessary to get the best and most economical results from it." Acquainted with most of the "gas engineers" in the country, we do not know of one who would have made himself responsible for such arrant nonsense. The object of every gas undertaking to-day, if it wishes to live, is to give satisfaction to consumers through the gas supplied. If the gas is of the right calorific power, composition, and specific gravity, with a pressure sufficient for all purposes, controllable by tap or regulator at the point of consumption, there is the sum of what is needed to obtain good results and economical operation.

How Not to Do It.

But this "Gas Engineer" enters into an elaborate statement with the view of showing that economy is to be obtained by reducing pressure, by muddling about with the meter-tap, as though incandescent burners cannot be regulated by the means embodied in them, and by the tap itself. "Gas Engineer" seems ignorant on the subject of the range of pressure that can be dealt with by the regulator only on an incandescent burner, in a district in which gas of fairly constant quality is supplied. In experiments conducted by one of the Technical Committees of the German Gas Association last year, it was found that variations of pressure from 16-10ths to 4 inches do not, regulating by the ordinary devices, make any difference to the duty obtained from the burners. This being so, why trouble about the meter-tap? If the quality of the gas is high, or the pressure is above 4 inches, then a different burner nipple is required. But excessively high quality gas is not at all desirable for bunsen burners, and is not generally supplied in England. Pressures of over 4 inches for domestic purposes are rare. The great efficiency of the high-pressure lamps is achieved by high pressures and specially constructed lamps. Then there is in the article a stupid suggestion of dishonesty on the part of gas companies. Their fitters, says this remarkable "Gas Engineer," branch out the orifices of oven burners and boiling-rings, so that they pass more gas. If

this were the case, we do not know why gas authorities should trouble about supplying their consumers with cookers that will give them the best efficiency. Their object should be to buy the worst possible and most wasteful on the market. This adviser of the public says, if the flames show the slightest trace of yellow, there is too much gas passing for the air supply; and, instead of adopting the simple expedient of seeing that the air supply is not choked in any way, and reducing the amount of gas passing by turning the tap, he suggests hammering-over the surface of the burner nipple with the flat face of a light hammer. The German experiments show that, for boiling purposes, using the same kettle and the same nipple, the efficiency was reduced when the pressure was increased from 16-10ths to 39-10ths. But by how much? Only from 55·25 to 50·7 per cent.; and the time occupied in the operation of boiling was less. We rather think that consumers will save themselves trouble by not hammering-up the nipples of burners on gas-stoves which they have hired from a gas company. The advice of "Gas Engineer" is dangerous. The best way for consumers to save, to compensate for the increased cost of gas, is to stop the prodigal use all too common owing to normal cheapness and handiness, as well as to carelessness.

LONDON GAS PRICES.

A "Temporary Increase" by the South Metropolitan Gas Company.

The following circular was issued last week-end by the Board of the South Metropolitan Gas Company.

It is with great regret that the Directors of the South Metropolitan Gas Company give notice that, from the present quarter, the price of gas to ordinary consumers will be raised to 2s. 10d. per 1000 cubic feet, and in the same proportion to slot-meter consumers.

The causes of the increase are fourfold:

1. The enormous rise in the cost of freightage or transport of coal from the North to London.
2. The increase in the price of coal at the pit's mouth.
3. The war allowance paid to employees.
4. The dislocation of business brought about by the lighting regulations.

On the other hand, there are some savings:

1. The shareholders' dividends are automatically reduced by Act of Parliament as the price charged for gas rises.
2. For the same reason, the bonus earned by the co-partner employees will be at a lower figure.
3. Residual products are fetching better prices.

The last three items of saving would nearly balance the cost of Nos. 2, 3, and 4 in expenditure; so that, had it not been for the freight difficulty, the Company would have been able to get through without the present increase in the price of gas.

The freight question has already been explained to the gas consumers in the circular sent out (above the signature of the Company's Secretary) on Jan. 20 last, and is shortly as follows.

The Company had chartered ships to bring its coal to London. The Government took these steamers, with others, for the supply of coal to the fleet. The withdrawal of so many steamers from the coasting trade artificially inflated the prices asked for those not so commandeered. After considerable pressure, the Government at last released some of the enemy steamers interned at various ports; but, instead of hiring them at the price paid for the commandeered steamers—say, from 3s. 6d. to 4s. per ton of coal carried—the Government has actually charged, and this Company has paid, no less than 10s. per ton. Who can blame the shipowners for following so bad an example, even though they may be ashamed of doing so? The present increase, therefore, in the price of gas arises wholly from the cost of freight; and, to get over this, the Company will as soon as possible take the carrying of coal into their own hands by purchasing the necessary steamers. When the advantage of this is felt, the present temporary increase in price will be at once reduced.

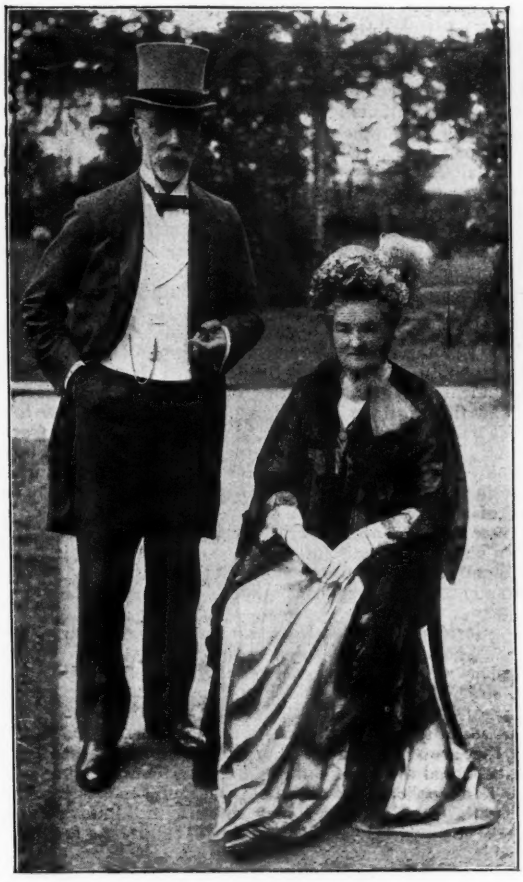
Some misapprehension exists about the position of gas undertakings generally. They are often called monopolists. The only monopoly they have is the power to lay pipes in the streets. At one time various gas companies used to do this in several streets at once—to the public detriment, and at the public cost. Parliament corrected this defect by giving the necessary power to one company in each area, and also regulated the dividends by means of a sliding-scale. The dividend payable with gas at the increased price will yield rather less than 3¾ per cent. on the capital actually raised during the past twenty-five years for the purposes of this undertaking.

CHARLES CARPENTER,
Chairman of the Board of Directors.

709, *Old Kent Road, S.E., March*, 1915.

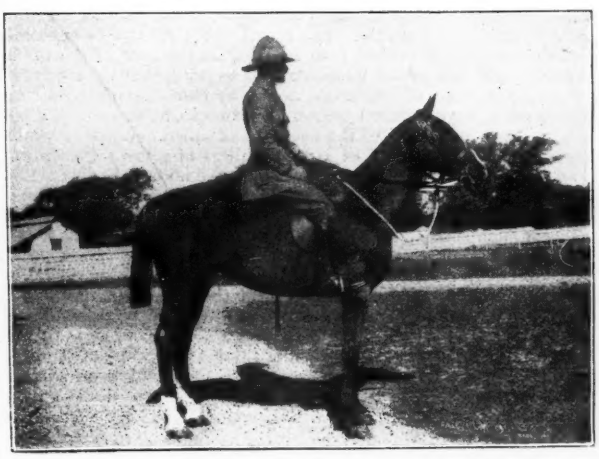
The following note is added to the circular: The Prime Minister has stated that coal may be considered the life-blood of the country. This life-blood is being drained from England's industries and needs by the export of coal abroad at the rate of 3,613 000 tons during January last and 3,630,000 tons during February.

1865—1915.



Photograph of Sir Corbet and Lady Woodall, taken at the Garden Party at "Walden," Chislehurst, in 1913, on the occasion of the Jubilee Meeting of the Institution of Gas Engineers.
[Previously published in the "Journal," June 24, 1913, p. 921.]

YET another jubilee! We trespass on personal friendship and a little piece of confidence of some time since, and without making any apology for doing so, in order to express on our own part, and in the name of our world-wide readers in the gas industry, the heartiest felicitations to Sir Corbet and Lady Woodall on this the fiftieth anniversary of their wedding-day. The happy event which made one of two lives on March 23, 1865, was but the beginning of a continual and still flowing stream of pure devotion and domestic blissfulness, and through these years courses the affection of united and devoted sons and daughters, and now of grandchildren. Amid sunshine, or under cloud to which all are more or less subject, there has been oneness. For both Sir Corbet and Lady Woodall the long road, measured by the fifty years, is pleasant to look back upon. The tide of years flows on; and on this golden wedding-day, while uttering heartfelt felicitations, we also express the fervent hope that there may be more years of united life remaining to the happy pair, and that the years may be bathed in the sunshine, and crowned by the peace and joy, which such revered lives so richly merit.



Major Harold W. Woodall.
Photograph taken at Poona, on Feb. 7 this year.

THE GAS INDUSTRY AND THE WAR.

Captain W. R. Glover, a Director of Messrs. Glover and Main, Limited, has been promoted to the rank of Major, 1st Battalion City of London Royal Fusiliers.

An order has been published in the "London Gazette" amending the Proclamations in force prohibiting the export of certain goods to all destinations abroad other than British Possessions and Protectorates. The articles now added include ammonia and its salts, whether simple or compound, other than ammonium nitrate, perchlorate, and sulphocyanide (the exportation of which is already prohibited to all destinations); ammonia liquor; and the compounds of aniline, except aniline salt (the exportation of which is already prohibited to all destinations). Among further articles the export of which is prohibited to all destinations are thorium oxide, thorium nitrate, and other salts of thorium.

The Gas Light and Coke Company, who have a contract with the Kensington Borough Council for the supply of coke to the town-hall and various departments, have notified that, owing to recent developments in the London fuel market, brought about by the war and the shortage of coal, a charge of 20s. 8d. per ton, as against the contract price of 16s. 8d., would be made as from the 1st inst. Reporting upon this intimation, the General Purposes Committee of the Council point out that the Company, under a clause in the contract, are exempted from delivering coke in the event of a strike or lock-out, or any fire, accident, war, or other unforeseen cause; and that the Company might reasonably take shelter under this clause of the contract. In the circumstances, the Committee express the opinion that the Council have no option but to pay the enhanced price quoted.

The Secretary of British Dyes, Limited, states that the number of applicants for shares was 880, involving 571,000 shares, of which 83,000 were conditionally applied for. The Directors do not feel justified, on such a subscription, in proceeding to allotment; and having regard to the gravity of the situation and the serious result to many industries if the scheme is not carried into effect, they are of opinion that it is incumbent upon them to adopt the exceptional course of calling the subscribers together. They desire that applicants should be given full opportunity of considering the position with a view to the subscriptions being increased. Unless, he adds, the trade will extend the further support which is necessary to justify the Directors in proceeding to allotment, there will be no alternative but to abandon the scheme and so lose the advantage of Government assistance. A meeting of applicants for shares will be held to-morrow (Wednesday) at Manchester to consider the position.

At the meeting of the Tottenham District Council last week, the Finance Committee, reporting with regard to the accounts of the Tottenham District Light, Heat, and Power Company for lighting for the Christmas quarter, stated that the Company had pointed out that all they saved by the diminution in lighting was the actual cost of manufacture represented by the price of coal, less the value of residuals, the cost of purification, and carbonizing wages. Salaries and repair of works were entirely unaffected by the non-manufacture of gas required for ordinary public lighting. The Company were prepared to make an allowance to the Council of £206 7s., less £8 5s. discount. The Committee recommended that this should be accepted without prejudice; and it was carried.

Mr. J. P. Houlton, one of the best-known authorities on mining matters in the Midland Counties, and the Managing-Director of a group of collieries which includes one of the principal Nottinghamshire pits that has established a world's record for output within a given period, has made a practical suggestion regarding coal supply—proposing that the present shortage should be remedied by stopping the export of fuel to neutral countries. Denying that the owners were rapacious, he gave some reasons why the cost of coal has gone up. In normal times there was exported between 70 and 80 million tons, or about 25 per cent. of the whole output; and one would have thought, he said, that the stoppage of a large portion of this trade would, by throwing more coal on the market, have reduced prices. There was, however, still a big export trade going on to the neutral and allied countries; while, owing to the enlistment of large numbers of miners, the output had gone down by an amount equal to the normal export trade. He estimated that the output in this country to-day was 20 per cent. less than before the war. High freights had also had a great influence on the prices. The demands of the Government, of steel and iron works, of woollen mills, and now of cotton mills, were very heavy. So far as the steam and gas coal collieries were concerned, and to a large extent the house-coal collieries, the appreciation in value had not gone into the pockets of the coalowners. It was customary to contract for from 80 to 90 per cent. of the output; and he did not think 2½ per cent. of the coal at the collieries with which he was connected had been sold at these high prices. The output of the collieries was down 20 per cent., and their profits by the same amount. The owners were worse off than before the war.

Referring to the circular of the Local Government Board [*ante*, p. 644], on the subject of releasing from municipal work men suitable for enlistment or for arsenals, dockyards, and armament factories, "The Times" says that local authorities are finding difficulties in the way of complying with the request. The chief complaint is that no definite plan for the suggested transfer of labour is set out in the Government circular, and that, anxious as the authorities are to assist the Government, there is likely to be considerable wastage unless some machinery is provided to ensure the right men being drafted to the right places. Already, it is pointed out, many municipalities are working with reduced staffs; and there are departments of municipal work in which skilled men are engaged which must be carried on. Many municipalities, besides producing electricity for their own requirements, are under contract to supply manufacturers.

Mr. R. C. Maxwell conducted an inquiry at the Bradford Town Hall last Wednesday into the City Council's application to the Local Government Board for the issue of a Provisional Order to partially amend section 54 of the Bradford Corporation Act, 1903 (which empowers the Corporation to raise money by means of bills), so as to increase the aggregate amount payable on bills which may be current at any one time from the sum of £500,000 to £1,000,000. Within the last six weeks, it was stated, inquiries of the same kind have been held in respect of similar applications by the Corporations of Liverpool, Birmingham, Birkenhead, and other bodies.

An announcement is made by the Instructional and Experimental Works at Carlsruhe of the German Association of Gas and Water Engineers that, in consequence of the absence in the field of the whole of the staff of the works, no holiday course of training for gas engineers can be given this year. Those who had already entered for the course will be given priority in the next course, whenever it takes place.

An article contributed by the German Continental Gas Company, to the "Journal für Gasbeleuchtung" of the 6th inst., on the "German Gas Industry under the Shadow of the War," indicates that the German works of the Company have suffered less decrease in output of gas than most German works. But for the war, the Company would have experienced an increase of output of 5 to 10 per cent. on that of the corresponding period twelve months previously. The war, however, has brought about decreases in consumption from the German works of the Company of 0·5 per cent. in August, 6·0 per cent. in September, 8·4 per cent. in October, 5·7 per cent. in November, and 5·2 per cent. in December, compared with the same months of 1913. In none of the Company's works has the decrease in any month exceeded 20 per cent. The diminished consumption is stated to be chiefly in factories working for export trade, glass works, fashion businesses, railway stations, dancing and assembly halls, and in some cases in public lighting. On the other hand, there is a large consumption of gas in new military camps and hospitals for cooking and water heating, and in prisoners' camps for extensive outdoor lighting. The scarcity of petroleum and the higher price of spirit have also stimulated the consumption of gas. Nothing is said in the article as to the largest works of the German Company—those at Warsaw.

By way of comparison with the experiences of this particular German Gas Company, it may be mentioned that statistics which have just been published by the Berlin Central Gas Publicity Bureau show that in November last the total gas production in 619 German works was 9·2 per cent. less than in November, 1913. The decreases for August, September, and October were 4·4, 10·7, and 11·1 per cent. respectively, as has already been stated in the "JOURNAL" [*ante*, p. 242]. There was, however, in November an increase of 5·4 per cent. in the number of gas-meters in use in connection with 542 German gas-works, and an increase of 17·3 per cent. in prepayment meters alone, so far as 451 gas-works were concerned.

The effects of the war on the German sulphuric acid industry have been dealt with by Herr K. Reusch in the "Chemiker Zeitung" [No. 38; 1914]. The following particulars are taken from an abstract of the article in the "Journal of the Society of Chemical Industry": The export of sulphuric acid, sulphuric anhydride, and sulphurous acid from Germany is now prohibited. The total German production of sulphuric acid in 1912 was 1,649,681 metric tons, calculated as monohydrate; and in 1913 the imports exceeded the exports by 65,289 metric tons; most of the imports being from Belgium. Of the requisite pyrites, more than 80 per cent. was imported, mainly from Portugal, Spain, and France. The working of the considerable German deposits might present difficulty owing to scarcity of labour. Norway is indicated as a further possible source of supply. No data are available respecting the amounts of nitre and nitric acid used in the manufacture of sulphuric acid; but in 1911 the contact process was employed in 7 of the works, the chamber process in 86, and both processes in 17. The price of nitre has risen; and discussing sources of such material, reference is made to the Norwegian production and the present strenuous German efforts to convert ammonia into nitric acid on a large scale. In view of the increased demand for sulphuric acid in manufacturing explosives, the price has risen slightly; and it is recommended that some economy

should be made in the superphosphate industry, for which 600,000 metric tons of acid were used in 1909.

The Watch Committee have reported to the Lincoln City Council the contents of a letter, recently received, from the Officer Commanding the Lincolnshire Coast Defence, stating that normal lighting might be resumed in the city streets. The Committee, however, took no action in the matter. Several members of the Council thereupon protested against the present lighting, and asked why no steps had been taken to revert to normal conditions. The Mayor (Mr. K. A. Ashley), in reply, said that, as a member of the Defence of the Realm Committee in Lincoln, and having attended nearly every meeting of the Watch Committee for the last few months, he could assure them that the Committee, with the exception of one member, were absolutely unanimous in their decision with regard to lighting. But if they cared to comply with the Standing Orders, and send him a petition signed by five members of the Corporation, he would call a special meeting of the Council, so that they might reverse the position if they liked. In that case, however, they would take the responsibility. The protection of the Lincoln public was a question for the Council, not for the military; and they knew that if enemy aircraft were sighted near the coast they could almost arrive at the city before notification of their approach could reach Lincoln.

The Skipton Urban District Council, upon a report by the Gas Committee that serious difficulties are being experienced through the enlistment of men, decided to let the men understand that if they enlisted it did not necessarily follow that they would receive half wages, or that their situations would be kept open. A resolution passed at the commencement of the war that such promises should be made to men was rescinded.

PERSONAL.

Mr. TRIGGS, Assistant Manager at the Swinton Gas-Works, has obtained a similar position with the Pontypool Gas Company.

Mr. JOHN R. GENTRY, of Dundee, has been appointed, out of 53 applicants, Manager of the Gourock Gas-Works, in succession to Mr. Thomas Lindsay, who has retired.

At the meeting of the Wrexham Gas Company, the Chairman (Mr. J. O. Bury) took advantage of the opportunity to present a gold watch to Mr. THOMAS HUGHES, the Works Foreman, who has been in the Company's employ for fifty years.

In connection with the reports of the proceedings at the last meetings of the Eastbourne and Reading Gas Companies which have appeared in the "JOURNAL," it is interesting to record the fact that the combined ages of the two Chairmen—Dr. G. A. JEFFERY and Mr. J. OKEY TAYLOR—amount to 180 years. The former has lately celebrated the ninetieth anniversary of his birthday, the latter will be ninety years of age on the 7th of June next. He has been Chairman of the present Company since its formation fifty-three years ago. His association with gas lighting, however, dates back to the year 1855, when he first became Director of the Reading Union Gas Company; being elected its Chairman in 1857. It was in 1862 that the present Company was formed by the amalgamation of the two undertakings which previously supplied gas to the town—viz., the Reading Gas Light Company and the Reading Union Gas Company. Dr. Jeffery, as already noticed in our columns, was elected a Director of the Eastbourne Gas Company in 1857, and became Chairman in 1860. Such records of service to the gas industry—running as they do almost concurrently—are remarkable.

Mr. J. M'NICHOLL, of Warrington, has been appointed Gas Engineer and Manager to the Mossley Corporation, in succession to Mr. James Taylor, who is leaving to take up a similar position with the Weston-super-Mare Gas Company. Mr. M'Nicholl received his training with the Sunderland Gas Company, under Mr. Charles Dru Drury, and subsequently served there as Chief Engineering Assistant for seven years. During this time he prepared plans for numerous extensions carried out at the Hendon works, and just prior to leaving for Warrington drew the plans for the complete reconstruction of the Ayres Quay works of the Company. He has been Assistant-Engineer at the Warrington Corporation Gas-Works, under Mr. W. S. Haddock, for the past eight years, during which time the make of gas has increased from 412 to 550 million cubic feet per annum, and the price has been reduced from 2s. 6d. to 2s. 1d. per 1000 cubic feet. With the price at the latter figure, record profits have been earned. Among other work, he has prepared plans for, and carried out, several important extensions at Warrington. Mr. M'Nicholl (who is President of the Manchester and District Junior Gas Association) holds certificates for first class honours in "Gas Manufacture" and "Mechanical Engineering" (City and Guilds), and also a large number of advanced certificates for engineering, chemical, and other subjects.

A meeting of the Illuminating Engineering Society will take place at the Royal Society of Arts, Adelphi, on Tuesday, the 27th prox., when a discussion on "Visibility in All its Aspects" will be opened by Mr. C. C. Paterson, of the National Physical Laboratory, and Mr. B. P. Dudding.

OBITUARY.

The death took place last Saturday night of Mr. WILLIAM GRAHAM, of Skipton. Deceased became a member of the Skipton Urban District Council in 1902, and was Chairman of the Gas Committee for several years, during which period the gas-works were considerably extended and modernized.

The Hexham Gas Company have just lost by death their Chairman, Mr. DIXON PRATT. He had filled the position for upwards of fifteen years, having succeeded the late Dr. Thomas Stainthorpe in 1899. He had, however, been a Director for about forty-six years; his father, the late Mr. Thomas Pratt, having preceded him as a member of the Board. Deceased suffered from an attack of bronchitis, and was unable to attend the annual meeting of the Company on the 10th inst.

The death occurred on Monday last week, at his residence at Blackpool, in his eighty-sixth year, of Mr. JAMES JACQUES, who for a quarter-of-a-century was Gas Engineer to the Stockport Corporation. He relinquished the position early in 1891, on the ground of ill-health, and was succeeded by Mr. S. Meunier. Mr. Jacques joined the British Association of Gas Managers in 1875, and passed into the Gas Institute; but his membership ceased in 1883. The funeral took place at Stockport last Friday.

Mr. WALKER CLAPHAM, a member of the firm of Clapham Bros., Limited, Keighley, died last Sunday at his residence at Silsden, after a long illness. He was in his sixty-fifth year. He was the second son of the late Mr. William Clapham, one of the founders of the above-named firm, brother of Mr. T. S. Clapham, who died a few weeks ago with tragic suddenness while attending a meeting at the Keighley Victoria Hospital, and of Mrs. Clough, the wife of Mr. W. Clough, M.P. He leaves a widow and one daughter.

The death occurred on Monday last week at Harrogate, in his fiftieth year, of Mr. WILLIAM FERGUSSON, the Manager of the Barrow-in-Furness Corporation Gas and Water Works. Deceased had been in ill-health; and a few weeks ago he went to Harrogate in the hope of obtaining some improvement. He had been for thirty-three years in the service of the Corporation, succeeding his father as Gas and Water Manager twelve years ago. He leaves a widow and one son. The funeral took place at Barrow last Thursday, and was attended by the Mayor (Alderman A. Barrow), the members of the Corporation, the borough officials, the Assistant Gas Manager (Mr. F. Chadderton), and members of the staff of the gas-works. Mr. John Swan, Gas Engineer and Manager of the Ulverston District Council, was also present. The coffin was followed by a large contingent of employees.

Some readers may remember the name of M. EMILE-HILAIRE AMAGAT, who attained considerable prominence in connection with his researches on high-pressure gas. We learn that this distinguished scientist has lately died. Born in 1840, he commenced his researches when he was appointed Professor at the Ecole Normale of Cluny in 1867. Later, at Lyons, he erected a mercury pressure-gauge in the steeple of a church, to give pressures of 80 atmospheres, and another in a coal-mine near St. Etienne, to give pressures of 430 atmospheres. In other apparatus which he himself constructed with the assistance of his mechanic, he realized pressures of 3000 atmospheres. In his later years he preferred to be Examiner rather than Professor at the Ecole Polytechnique, because the former appointment left him more time. Failing health induced him to retire a few years ago. He was a foreign member of the Royal Society, and an honorary member of the French Physical Society, whose President he was in 1906.

The death of Mr. WILLIAM CASH, of Louth, at the age of 88, removes one who not only laid the foundations of the present prosperity of the Louth Gas Company, but one who showed his faith in gas manufacture as an investment by holding shares in gas companies all over the country. He was the oldest Director of the Louth Gas Company, having joined the Board in 1858. For twenty or thirty years he took an active part in its affairs, to the great benefit of the Company. During the years 1825-29, the Company only paid a dividend in one year; and up to 1844 the dividend never exceeded 5 per cent. Again in 1856 and 1858 there was no dividend; and the highest dividend in thirty years was 8 per cent. The prosperous era in the Company's affairs dates from the time when (in 1858) Mr. Cash became a member of a Committee to report on the working of the Company. It was in such a chaotic state that the Committee, in order to get reliable data to report upon, had to calculate from the consuming point to the manufacturing point under circumstances of peculiar difficulty. Three years after he joined the Board, the dividend rose to 12 per cent.; back-dividends were being paid; and there has since been no set-back to the Company's prosperity.

Messrs. Fletcher, Russell, and Co., Limited, announce that, on and after the 29th inst., the address of their London offices and show-rooms will be Nos. 15 and 16, Fisher Street, Southampton Row, W.C., where they will have on view a large and varied selection of gas cooking, heating, and laboratory appliances, mantels, interiors, &c.

DEATH OF MR. JOHN CARTER.

THE Eastern Counties Gas Managers' Association have lost a prominent member, and the Lincoln Corporation an able and loyal official, in the person of Mr. John Carter, the Gas Engineer and Manager, who, we regret to announce, succumbed last Tuesday to an attack of pneumonia and other troubles following a cold. The sad event came after only a short illness, as Mr. Carter was attending to business as usual on the 6th inst.

Mr. Carter was a native of Lincoln, and began his working life in the offices of the old "Lincolnshire Chronicle." His association with the Lincoln Gas-Works commenced in 1880, when he was appointed Secretary of the Gas Company on the death of Mr. W. P. Throsby. He held the position for four years, and was then appointed Manager as well as Secretary. The Company was formed in 1828, when gas was first introduced into the city; and many of the old features of the works were in existence when Mr. Carter entered upon his duties. He effected some considerable improvements; and when the Company's undertaking was acquired by the Corporation in 1885, he was retained as the Engineer and Manager. Under his supervision the old Newland works were modernized, and the larger works at Bracebridge, which date from 1876, were greatly enlarged, becoming the principal manufacturing station. Mr. Carter was always ready to recognize the value of labour-saving machinery; and apart from many other features, Lincoln was one of the first cities to have automatic stokers in its gas-works. From an annual make of 120 million cubic feet of gas in 1880, the works have been developed to be equal to the production of nearly 410 millions in the financial year 1913-14; while the make per ton of coal has increased from 9267 to 11,339 cubic feet. From 1897 there has each year been allocated from the gas profits a certain sum in relief of the rates; and up to the present date this aggregates no less than £52,700.

As Manager of the gas-works, Mr. Carter was always on good terms with the men; and on the completion of twenty-five years' connection with the gas-works, he, early in June, 1906, entertained at tea the Mayor and members of the Corporation, the staff, and the workmen—all the latter (both day and night hands) being present. On that occasion, the Mayor, in proposing the health of Mr. Carter, said the Corporation had many officials, but there was not one connected with the permanent work who was more universally respected in the city than the Gas Engineer. The remark was greeted with loud applause. His Worship went on to say that if he were Mr. Carter, he should appreciate very keenly that burst of applause, because the bulk of those round the tables were practically in the position of being Mr. Carter's employees; and he could conceive of no more satisfactory reward for any man than that, after having lived for twenty-five years with his employees, he should be greeted with such enthusiasm. It showed that he had solved one of the problems of modern life, in the establishment of harmonious relations between employers and employed. A retired gas worker voiced the feelings of the men by saying that whenever they had to approach Mr. Carter they were always sure of a fair hearing.

Mr. Carter joined the Gas Institute in 1882, and he strongly advocated the amalgamation of this body with the first Institution. Our readers may probably remember that at the meeting of the Institute in 1901, Mr. Carter moved the adoption of the long report on the subject presented by the Council; and his excellent speech made a deep impression on the members. The motion was carried unanimously; and when subsequently Mr. Chester moved a resolution to the effect that the meeting endorsed the efforts of the Council to bring about the amalgamation of the two Societies, Mr. William Carr remarked that after the masterly speech of Mr. Carter the view put forward would commend itself to the members of the Institution. When the amalgamation had been duly carried into effect, Mr. Carter was placed upon the first Council of the new Institution—a position that he filled till 1906. Testimony to the respect in which he was held was afforded at the meeting of the Society of British Gas Industries last Thursday, when reference was made to the consideration he always showed to the interests of the manufacturers, while keeping in view those of the purchasers of their products.

Mr. Carter was one of the promoters, in conjunction with Mr. H. Wimhurst, of Sleaford, and Mr. John Barton, of Peterborough, of the Eastern Counties Gas Managers' Association, which was formed in September, 1888; and he was a member of the first Committee. The following year he was elected Vice-President, and was President in 1891. At the meeting in 1889 he read a paper on "The Commercial Policy of Gas Undertakings," in which he dealt with the proposition that a sound commercial policy is necessary for the full development of any business undertaking, and for the gas industry no less than the others. In his Inaugural Address at the spring meeting in 1891, he referred to some of the circumstances which were then of interest to the members as an Association of Gas Managers. In 1899, Mr. Carter read a paper dealing with the report of the Home Office Committee on the subject of carburetted water gas. The only other paper was one on "The Treatment of the Prepayment Meter Consumer," read by him at the meeting of the Association held at Lowestoft in the spring of last year. We somewhat adversely criticized the paper at the time, as we thought the views enunciated by the author were calculated to lead to complications and trouble in the Parliamentary Committee-Rooms. The paper did not receive the approval of several members of the Association, or of some others outside its ranks.

Mr. Carter, who was in his sixtieth year, leaves a widow but no family. The funeral took place on Saturday, and was attended by the Mayor and members of the Corporation, the city officials, a large gathering of citizens, and the following members of the gas profession: Messrs. J. Baldwin (Gainsborough), J. Barton (Peterborough), W. J. Rendell Baker, President of the Midland Association (Mansfield), F. Davies (Horncastle), J. S. Dougall (Boston), W. B. Farquhar, President of the Eastern Counties Gas Association (Ilford), J. B. Fenwick (Retford), F. Kent (Worksop), R. G. Shadbolt, representing the Institution of Gas Engineers (Grantham), J. Wilkinson (Nottingham), and H. Wimhurst (Sleaford). There were also present representatives of firms connected with the gas industry, who attended to testify the respect in which they held the deceased.

APPRECIATIONS.

We have received the following appreciation of the late Mr. Carter from Mr. R. G. SHADBOLT:

The passing of John Carter, of Lincoln, on Tuesday last, was an event which, even in these days of heavy calamities and mishaps, came to many of us as a rude shock, stirring the deepest feelings of grief and personal loss. To those who knew him intimately, and over any lengthy period, he was indeed a man among men. Of distinct literary ability, an eloquent speaker, a forceful debater, an earnest advocate, a fighting man of the first order, he displayed the utmost integrity in all his dealings. A remarkable personality, vengefulness and malice were foreign to his nature, versatility was a distinguishing characteristic, and he was a sportsman in the truest sense of the term. A man of strong convictions, on which he never hesitated to act or speak with scrupulous consistency, he ever displayed the broadest sympathy, and was exceptionally tolerant of disagreement and opposition.

If doing good to one's fellows is the standard of humanity, John Carter was human and humane to a degree. In him the victims of injustice and suffering found a ready champion, want and distress inspired him to quick and sympathetic response. "Sir," said one at his funeral, "I am a working man, and have known Mr. Carter from quite a boy. I have worked with him and under him in religious and other ways, and I can tell you there are many sad hearts in Lincoln City to-day, and many who will miss him sadly. It wasn't everybody who knew the good that man has done." What a eulogy! One feels proud to have known him. His fostering care of all who served under him is known to some of us, and surrounded him with a staff and body of workpeople both loyal and contented. In a word, John Carter was simply John Carter, and we are not likely soon to meet his counterpart.

Unlike the majority of gas men, he was a native of the city he served as Gas Engineer and Manager, and the progress of his career and that of the gas undertaking were synonymous. The citizens of Lincoln are under a great debt to our departed colleague—greater possibly than they yet appreciate; for his conduct of their gas undertaking was of a masterly order, and such as will redound to their benefit and his credit for many years.

Arguing from his own premises at Lincoln, he was a staunch defender of the municipal control of public services, while admitting that it is not given to every corporation departmental head to be so favourably placed in relation to the governing body, or to enjoy their confidence and esteem, to the extent enjoyed by himself. Possessed of shrewd commercial instinct, and a mind that never ceased to expand and develop, John Carter was a rare instance of the evolution of a successful gas engineer and manager from the clerical side; and evidence is not lacking to show that his Committee had sufficient appreciation of his manifold abilities to afford them ample play, to the distinct advantage of the whole community.

At twenty-four years of age, he transferred his affections from a journalistic career to the gas industry, by taking up the position of Secretary to the old Lincoln Gas Company, and again transferred his allegiance to the Corporation when they became the proud possessors of the gas property. In due time, he became the General Manager, &c. Thirty-five years' continuous responsible service in the one undertaking, with a progressive rate of development in services rendered, and constantly diminishing cost to the consumer, is the worthy record of a worthy man.

We of the gas industry who marked and appraised the sterling worth of his services to his native city, were cognizant also of other spheres in which he laboured most assiduously for the advancement of the industry itself, and its utility to the country at large. A founder of the Eastern Counties Gas Managers' Association, he rendered yeoman service in consistently and persistently promoting its objects, from the day of its formation to the day of his death. Services asked of him were most cheerfully rendered, from the occupancy of the presidential chair to the simple proposing of a vote of thanks. The official "Transactions" are rich with gems from his tongue and pen. Times innumerable did he lay the Association under obligation; and one can recall instances when, with a lean programme before it, the meeting was whipped into life by a serviceable debate quietly engineered at the instigation of our lost friend.

But what of the unrecorded proceedings. The quiet *tête-à-tête* with a colleague in difficulties; the cracking of the latest joke

(for even gas men have been known to see the point); the restful "rubber" after the proceedings had terminated; and last, but not least by any means, Carter's after-dinner toast, when, were he proposer or responder, never mind the subject, let it but be known that "it's Carter's turn next," and the vacant seats filled as by magic, hearers astretch to mark his points and to capture his flashes of wit and humour! Sense of humour? Yes! he had, as many of us became aware through the medium of the slyest of digs and the most delicate innuendo.

But, to go farther afield, the old Gas Institute and the present Institution of Gas Engineers likewise remain his debtors. Many and varied were the ways in which he rendered the service most needed at the moment. Many there are who still remember his statesmanlike utterances at the 1900 meetings of the old Institute, when a futile effort was made to effect amalgamation of the two National bodies, which proved, however, but the beginning of the process which culminated successfully in actual amalgamation three years later. Few there be who are fully aware of the solid assistance given to this end, both as an ordinary member and as a Member of Council, by Carter, of Lincoln. Eight years in all did he serve as a Member of Council; first of the Institute and then of the Institution. Further, if one may raise the curtain for a fleeting peep behind the scenes, it is to disclose the fact that, at one time, nothing but his innate modesty stood between himself and the presidential chair.

In all things connected with our technical organizations, John Carter was a force, at once uniting and stimulating; and, orator that he was, one is fain to admit that he wielded even more influence in this direction by personal example and action than by the eloquently spoken word.

But methinks that, withal, the most gratifying feature to his friends and intimates of the gas industry lies in the fact that he was a real glowing example of the exception to the time-honoured rule: "A prophet is not without honour save in his own country," for in the hearts of his fellow-citizens his honour is treasured and cherished; to them his death is a very material loss. In the industry which he served so well, his passing has occasioned the greatest sadness. Time alone will enable us to appraise his full worth. As colleagues and as friends, we mourn with a double grief, for a *man* has gone out from among us.

Mr. W. H. MAINWARING, Mr. Carter's Assistant for many years at Lincoln, writes as follows:

It is, of course, impossible, at this short interval, to obtain a correct perspective of the extent of the loss which his friends, both in the gas industry and in his native city, have sustained by the death of John Carter. It is perhaps permissible at the present moment, however, to endeavour to realize some of the impressions he has left in our minds—his legacy, as it were, to those who came into intimate relationship with him.

Devoted as he was to his work, and his chief aim the attainment of the best that could be obtained from the undertaking under his charge, Mr. Carter was never so happy as when called upon to help members of the profession who sought his aid or advice. Of not many men could it be so truly said that he had a host of friends; and as for his enemies, I know of none who could be truly so described.

He was perhaps seen at his best at those formal and informal gatherings of gas men which he loved to attend. His invariable courtesy, his particular ability in matters financial, his never-failing command of the right word in the right place, and the reliance which could be placed upon him to say that word whenever he was called on to do so, will be allowed by all who had the satisfaction of meeting him on these occasions.

In many directions, John Carter had his own point of view; and this did not always coincide with that of his hearers. For example, his last paper at the Eastern Counties Gas Managers' Association raised a most decided controversy; and he could by no means be said to have carried his audience with him. But the charm of manner and the self-evident sincerity underlying all he said were sufficient to keep the air clear from any trace of personal unpleasantness; and although they were most decidedly unconvinced, his friends liked him none the less for his heresies. The same remark applies with reference to his political opinions which can hardly be said to have been in harmony with those of the great majority of his friends, but which nevertheless lost him none of their affection and esteem.

Of his many private charities it is unnecessary to speak; but reference might be made to the manner in which some of his scanty spare time was spent. His office was in times of distress the distributing centre for a considerable local charity. Not only in the evening but in business hours (as many gas men can testify), those who sought help found a sympathetic listener; and Mr. Carter had ample scope for the display of tact and discrimination. In this direction his place will not be easily filled.

As for those whose privilege it was to come into daily personal contact with John Carter, they will miss him most, and mourn his loss most deeply. Let it suffice that one who knew him best, and valued him highly, may place on record his testimony to the uniform and unvarying unselfishness of his departed Chief, who was always more tender of the interests of those who worked under him than of his own. For himself he was never sufficiently careful; and it is morally certain that his death at a comparatively early age was largely due to this trait in his character. Be this as it may, the grave has closed over a lovable, kindly, and gentle man, whose memory will be green for many years in the hearts of those who knew him. This is surely an end which the best of us may hope to have achieved when our time comes to pass beyond.

THE LATE MR. WILLIAM BLAIR.

IT was briefly recorded in the last number of the "JOURNAL" that Mr. William Blair, the Gas Engineer and Manager to the Helensburgh Corporation, had met with a serious accident while cycling on the 13th inst., and that unfortunately he had succumbed to the injuries he sustained. His death removes a member of a family who have long been connected with the gas industry, and one who had attained a prominent position among his colleagues north of the Tweed. It was once said of him that he was born, cradled, and reared in a gas-works. His grandfather was Manager of the Johnstone Gas-Works as far back as 1818—near 100 years ago; and his father and uncles were members of the gas profession.

Mr. Blair was born at Girvan, in Ayrshire, in 1853. Starting as a messenger boy in the Johnstone Gas-Works, he steadily worked his way up through all the grades of a Provincial gas-works—looking after the water-traps, reading meters, delivering accounts, laying mains and service-pipes, and actually for two years working as a stoker. He then engaged himself as an apprentice engineer with Messrs. Laidlaw, Sons, and Caine—a firm which became the Barrowfield Iron-Works, Limited—where he gained considerable experience in the construction and erection of gas-works plant. He was afterwards with the Great Western Railway Company, at Swindon, and with Messrs. Neilson, Reid, and Co., Limited, at the Hyde Park Locomotive Works, Glasgow. His first appointment as gas manager was in 1883, with the East Wemyss and Buckhaven Gas Company, in succession to his father; and he remained with them for about six-and-a-half years. On the resignation of Mr. James Robb, he was selected to succeed him as Manager of the Haddington Gas-Works. In the ten years during which he held this position, he remodelled and enlarged the works in all the manufacturing departments, so that they had double the capacity they had when he was appointed. In 1899 he obtained the position of Engineer and Manager of the Helensburgh Gas-Works, in succession to Mr. William Smith, who, after serving the Gas Company for more than half-a-century, was relieved of his duties on the undertaking being acquired by the Corporation.

Soon after Mr. Blair's appointment, the Corporation began to make extensive alterations to the gas-works; additional storage being provided by the erection of a new holder. The excellence of Mr. Blair's management was shown the third year after the transfer, when there was a profit balance of £8311; and he was awarded an advance of £20 a year in his salary. Towards the close of 1908, further storage was provided by the erection of a gasholder on the Gadd and Mason principle. About two years later, the Corporation, on the recommendation of a Special Sub-Committee, sanctioned the erection of an installation of vertical retorts on the Glover-West system (the first in Scotland), at an estimated cost, with ancillary works, of about £14,700. It was described by Mr. Blair in a paper he read at the meeting of the North British Association of Gas Managers in Glasgow in 1911; and at the following meeting he gave the members the result of a year's work. It may be mentioned that Mr. Blair's assistant, Mr. David Fulton, furnished further details of the working of the installation in a paper submitted to the Western District Division of the Scottish Junior Gas Association. [See *ante*, p. 594.]

Mr. Blair was a member of the Waverley Association, of which he was President in 1896. He could not deliver the usual address, owing to a bereavement; but he gave one at the close of his year of office. When he left Haddington to go Helensburgh, he was presented by his fellow-members and friends with a gold hunting watch, accompanied by a gold bangle for Mrs. Blair, in token of appreciation of his work. The presentation was made by HON. Sheriff Substitute J. C. Adamson, of Airdrie, who remarked that those who had had an opportunity of seeing Mr. Blair's work at Haddington would readily predict that he would produce equally good, or even better, results in larger works. This prediction was verified at Helensburgh. The price of gas has been reduced from 4s. 7d. to 2s. 6d. per 1000 cubic feet, and other concessions have been made to the consumers. The make has increased from 42 to nearly 80 million cubic feet; and the unaccounted-for gas reduced from more than 20 to less than 8 per cent. Mr. Blair was President of the North British Association of Gas Managers in 1908, on the occasion of the forty-seventh annual meeting; and in the course of a short address he referred to the different systems of vertical retorts which had then been brought under the notice of the gas profession. In company with many members of the Institution of Gas Engineers, he visited Berlin, on the invitation of the German Association in June, 1908, and was much impressed with Bueb vertical retorts. He, however, as already stated, favoured the Glover-West system for Helensburgh. He was a member of the Institution of Gas Engineers, having been elected in 1908; and he was a strong advocate of the affiliation with this body of the North British Association.

Mr. Blair was a devoted Freemason, and was a member of the

local Lodge. He also took a keen interest in public affairs. He was in his sixty-second year; and he leaves a widow, two sons, and two daughters. His elder son is with Messrs. Parkinson and W. & B. Cowan in Manchester; and the younger one, Sergeant James Blair, is at present with the Argyll and Sutherland Highlanders (Territorials), on active service in France.

Mr. DAVID FULTON, the Assistant Gas Manager at Helensburgh, has courteously sent some particulars of the late Mr. Blair's life-work similar to those given above. He adds:

Mr. Blair left his house early in the afternoon of the 13th inst. to go to Garelochhead on his cycle, which was propelled by an auto-wheel, and he was little more than a mile from home on the return journey when, from some unexplained cause, he was thrown from the machine, and sustained a fracture of the skull. He died the following morning without regaining consciousness. Of a striking personality, and straightforward, generous nature, Mr. Blair exemplified a type of shrewd "pawky" Scot who are becoming scarcer. Full of enthusiasm for his profession, he was one of the most genial and vivacious figures connected with the industry; and his cheery presence will be missed by colleagues, by whom his company was courted, and among whom he was universally popular. His courage and progressiveness were borne out by his adoption of vertical retorts, for most men of his years are apt to look askance at new methods. A true Ayrshire man, Mr. Blair was intensely patriotic, and a great admirer of the National Bard, Robert Burns. Those who have seen him will not readily forget the picture he made while declaiming, with passionate fervour, some of the poet's most striking passages. The world can ill spare men of Mr. Blair's stamp; and the tragic manner of his passing has cast a gloom over all who knew him.

High-Pressure Gas Lighting at the Panama Exhibition.

At the banquet held in connection with the annual meeting of the New England Association of Gas Engineers, noticed last week, the Secretary of the Joint Committee on the International Gas Congress (Mr. G. G. Ramsdell) gave an outline of the present situation, and called particular attention to the fact that Mr. T. Commerford Martin, the Secretary of the National Electric Light Association, who had just returned from San Francisco, had spoken in very glowing terms of the wonderful display of lighting at the Panama exhibition, both by gas and electricity, the effect of which upon the walls of the buildings in which are suspended the scintillating jewels is not only novel but wonderfully attractive. We learn from the "American Gas Institute News" for the current month that at the conclusion of Mr. Ramsdell's remarks, Mr. J. B. Klumpp said it might be of general interest to gas men throughout the country to know that the gas street-lighting exhibition had been a great success. High-pressure gas lighting had been installed in the streets and pathways in the States and Foreign Building Sites, and had been most successfully undertaken and carried out, as was evidenced by a telegram just received from Mr. G. L. Bayley, the Chief of the Mechanical and Electrical Department of the exhibition. It was addressed to Mr. Arthur E. Shaw, President of the Welsbach Street Lighting Company of America, and was as follows: "We had a trial last night of all the gas-lamps in the States and Foreign Sites, and the results were most gratifying. A number of exposition and gas company officials were present, and all agreed it was the best street lighting they had ever seen. Many congratulations."

Carburetted Water-Gas Manufacture.—Mr. O. B. Evans has taken out a patent for America [No. 1,125,676, Jan. 19, 1915] as Assignor to the United Gas Improvement Company, of Philadelphia (Pa.), for a process of manufacturing carburetted water gas. According to an abstract of the specification in the "Journal of the Society of Chemical Industry" for the 15th inst., the "blows" of producer gas and the "runs" of blue (uncarburetted) water gas are passed succcessively in opposite directions through the carburetting chamber. The water gas is carburetted alternately at different points in the chamber, and the producer gas is burnt alternately at points opposite those at which the previous carburation was effected—the combustion products and carburetted water gas being withdrawn alternately at opposite ends of the chamber.

Seger Cone Manufacture in England.—We learn that an interesting experiment in the manufacture of Seger cones is being carried on in the Pottery Section of the North Staffordshire Technical College. These cones were once manufactured solely by the Prussian Government at the Royal Porcelain Works at Charlottenburg, and they were imported into this country in considerable quantities for use by pottery manufacturers in standardizing the fire of ovens and kilns. When the war broke out, and Seger cones were no longer available from Germany, the matter was at once taken into consideration by Dr. J. W. Mellor, Principal of the Pottery Section at the College. Successful experiments were made, and the Governors authorized the manufacture of the cones. The result is that they are now being turned out from the laboratory at the rate of 1000 a day; and as we understand Dr. Mellor has orders already on hand for 200,000 cones, the rate of output will shortly be increased considerably.

ELECTRICITY SUPPLY MEMORANDA.

A CHANGE has come over the relations between the gas and electricity suppliers of London; and to an extent the war has helped to promote the change. While both classes of undertakings have been worried over the supplies of coal, the engineers of electricity stations, with boilers of suitable type, and boilers fitted with forced-draught arrangements, have been fairly comfortable in the knowledge that, so long as gas-works had supplies of coal, it was pretty certain electricity stations could obtain from them coke or coke-breeze. One central station engineer has entered into a contract for gas coke; and while the coke is being delivered to him with constancy, he is stocking the coal that is coming in under a pre-existing contract, and so is not worrying himself in the slightest about fuel. The supply of coke and coke-breeze to central generating stations is now substantial in quantity; and the experience with these classes of smokeless fuel is not going to be of an ephemeral order. So it comes about that the business relations of the two commercial rivals are going to be of a closer nature than hitherto. The matter has received supplementary interest through the statements of Mr. W. H. Bowden, at the meeting of the South Metropolitan Electric Light and Power Company, as to the satisfactory experiments with, and now extended adoption of, coke-breeze for steam-raising—the source of supply being no farther distant from the generating station than the gas-works next door [see *ante*, p. 685]. A singular thing about the employment of coke or coke-breeze for steam-raising in electricity stations is that there are always electrical engineers to be found who have had, or profess that they have had, some most unpleasant experience with boilers through the use of such fuel. But a perfect avalanche of experience of a contrary nature can always be set in motion to subvert their smaller experience. One such electrical engineer is Mr. Horace Boot. He was present at the South Metropolitan Electricity Company's meeting when Mr. Bowden stated the plain facts of his experience. Mr. Boot foreshadowed a gloomy result—the life of boilers, according to his experience, would be reduced to one-half by the use of coke-breeze. Ever alert, the Fuel Expert of the London Coke Committee appears, and asks for details of Mr. Boot's experience. We have not, at the time of writing, seen a reply. In gas-works, the experience has no confirmation. Coke and coke-breeze are used under gas-works boilers, and always have been, quite as a matter of course; and Mr. Edward Allen told the Departmental Committee on Smoke Abatement, that he had a Babcock water-tube boiler, using coke fuel, running for fifteen years at the Liverpool Gas-Works, without requiring the renewal of a single tube. There is the splendid experience, too, at the Lyons gas and electricity station, where no less than 24 large water-tube boilers are fired with coke-breeze to produce steam for the generation of electricity. These boilers, like those of the South Metropolitan Electricity Company, are fitted with the mechanical stokers especially manufactured by the Underfeed Stoker Company, Limited, for burning coke-breeze. A considerable number of the boilers on gas-works are fitted with the Meldrum forced-draught arrangements and mechanical stokers; and there are many years' experience as to their efficiency. Of course, coke and coke-breeze are at higher prices just now; but gas-works with an eye to future custom are not making "war" prices out of these commodities. As the Fuel Expert of the London Coke Committee says, coke-breeze offers at the price the best value in London to-day for fuel for steam-raising. With, from the makers of furnace apparatus, a guarantee of an evaporation of 6 lbs. of water per pound of breeze, what more can be wanted?

Gas-Works as Fuel Suppliers to Central Stations.

Gas-Firing for Boilers.

Glasgow lately seems bent on experimental work. Not long ago information came to hand as to experimental work on the production of smokeless fuel at the gas-works; and now there is information as to the appointment of a Joint Committee of the Gas and Electricity Departments to consider the question of the gas-firing of the boilers at the electricity generation station. It looks like the case of a trial of producer gas, with bye-product recovery. Of course, there is nothing new in the gas-firing of boilers; although experience in this country has not been large away from blast-furnaces, coke-ovens, and the Mond gas-mains. There is also the experience with the Bonecourt surface-combustion method. But, instead of the putting down of new plant for gas production and the recovery of bye-products at Glasgow, why not use coke or coke-breeze from the gas-works for firing the boilers at the electricity station? It seems such an absurd thing, and contrary to economy, that two departments under one Corporation should be buying raw fuel, when one is a large producer from the coal carbonized of a very suitable fuel for steam-raising purposes, and one which most certainly does not pollute the atmosphere.

Capital Sanction.

Electricity undertakings, like gas undertakings, are going for a time to have dearer capital with which to work—that is to say, when successful in obtaining the sanction of the Treasury to the raising, during the war and for a year after, of

additional capital. The Hackney Borough Council have effected a loan with the London City and Midland Bank for £32,652 at 4½ per cent. for electricity-supply purposes. They ought to consider themselves lucky; but, on top of this, there is the provision for sinking fund. A more important matter is that the electrical industry is quite disturbed over the very strict blockade that the Treasury are maintaining over capital expenditure. The Borough Councils of London have to obtain authority to loan-raising from the London County Council; and now the latter, in their turn, before giving sanction, have to go to the Treasury. Complying with this new order of things, the County Council submitted to the Treasury various applications for loans—among them two from Battersea and Hammersmith for loans for electricity supply purposes. The Treasury decline to sanction these, expressing the opinion that it is desirable that capital expenditure by local authorities should during the war be restricted to the narrowest possible limits—in fact, approval to fresh borrowing powers will, they say, in all cases, be withheld in the absence of special considerations. What constitutes "special considerations?" Not the supply of fresh customers, unless this can be done from the present plant. Mr. H. R. Hooper, one of the Local Government Board Inspectors, said so at a recent inquiry at Heywood into an application by the Corporation for a loan of £12,450 for electricity purposes. He also gave an indication as to what was meant by "special considerations." "The matter," he said, "would have to stand over for the present; and further particulars must be furnished of the work absolutely required to be done to enable local firms engaged on Government orders to continue their operations." Government orders connected with the war therefore constitute "special considerations." Another "special considerations" appears (with qualification) to be the completion of works already in hand. This comes out in a communication to the Manchester Corporation, in which it is stated that objection will not, as a rule, be raised to the issue of fresh mortgages for replacing or renewing mortgages; but the Treasury will not sanction the raising of fresh capital for meeting new expenditure. "Capital expenditure," it is added, "ought not to be undertaken except for schemes and work in progress, which, even then, should be postponed if possible, or be spread over a longer period."

Electric Cooker v. Coal Range.

If all authors of papers and articles on the subject of electric cooking were as temperate as Mr. W. R. Cooper, and did not allow their enthusiasm to overrun discretion to any greater length, there would be little reason for criticism on our part. Mr. Cooper has been reading a paper on electric cooking before the Institution of Electrical Engineers; and throughout it bears the impress of an honest attempt to present facts and to make points only from experience. Therefore we are not going to criticize the main points of the paper, but propose to extract from it certain salient features. In the first place, the author makes the point that there is greater economy in the use of a large electric-oven when there are a good number of people to cook for, with more profit for the suppliers of electric current, than is the case with only a small size electric-cooker, and a few people to cook for. The same applies to the gas-cooker. Per head, it is much cheaper to cook on the large than on the small scale. This is why electrical operation in electricity advertising restaurants comes out much cheaper *per capita* than is the case with cooking on the small domestic scale. The number of persons in the household with which the author deals is normally eight or nine; and so a fairly large electric-cooker displaced the service of a coal-range. A coke-boiler was adopted for hot water. The initial outlay was as follows:

	£	s.	d.
Electric-cooker	23	15	6
Cooking utensils	2	5	0
Wiring for supply to cooker	9	4	5
Boiler and connecting-up same	10	6	4
	45	11	3

Later, a porringer taking 800 watts was added, which, with wiring, cost £4. The prices are list ones. But consider this cost for the equipment for families of eight or nine; and there are many such families among the middle class. Then as to running cost. Before electric cooking was adopted, the average annual cost (based on the two preceding years) with coal was as follows:

	£	s.	d.
Electrical energy for light and other purposes	9	0	0
Meters	1	0	0
Coal	13	10	0
	23	10	0

With electric cooking the result for the year was as follows:

	£	s.	d.
Electrical energy for light, &c., as above	2	16	3
Electrical energy for cooking (including fixed charge) 5024 KW.-hours (average price 1·04d. per KW.-hour)	21	19	0
Meters	1	0	0
Coke and coal	6	13	6
	32	8	9

The net result is seen to be an increase in cost of £8 18s. 9d. per annum over the cost of cooking with coal. The average consumption was found to be about 2 KW.-hours per person per day in the winter time, and about 1·6 in summer. This figure was obtained with a cook who might be described as "careful."

Mr. Cooper Enjoys a Preference.

From the above, it appears that, on the adoption of a cooker, Mr. Cooper's household was transferred from a flat-charge for electricity to a lump-sum annual payment, *plus* a low price per unit, which in the case of cooking works out to 1·04d. per KW.-hour. Taking the final group of figures, it would be interesting to know why Mr. Cooper is allowed to have the number of units he requires *for lighting* at £2 16s. 3d., while for a "corresponding supply" another man has to pay so much more. We see no reason why the author's average charge for lighting should work out to less than another man's who uses the same number of units for the "corresponding supply," any more than the Law Courts could see why a Long Eaton manufacturer using electricity for lighting should receive power units at a lower price than a manufacturer using a "corresponding" power supply. It may be said that there is no preference because the other consumer can come under the same system of charging as Mr. Cooper. Supposing that the consumer does come under the system, but does not want to use a cooker, and pay £8 18s. 9d. a year more than he is doing now with electric lighting and coal, why should Mr. Cooper have his lighting units at a lower average price than the other man can obtain his lighting units for? Lighting in both cases is a "corresponding supply."

Miscellaneous Points.

The comparison that Mr. Cooper makes is between a coal-range and an electric-cooker; and the net result is that, taking no account of the heavy initial cost of installation of the latter, the coal-range beats the electric-cooker, with the advantage of energy at an overall price of 1·04d. per KW.-hour (apparently both for lighting and cooking), by £8 18s. 9d. a year—the coal-range doing this with all its stand-by losses and irregularity in heating. This, too, with the electrical installation in the hands of a careful cook, and with a household that does not indulge in luxurious living—a household of a size that is an advantage on the side of electric cooking compared with smaller households. Passing on, it is found that Mr. Cooper's experience assures him that with electric cooking things should be made as easy as possible for the cook in regard to control. A main double-pole switch should be fixed in a handy position near the cooker; and a pilot light should be fitted so that the cook cannot help seeing whether the power is on or off. She should also be trained to cut the supply off at the main switch in addition to the subsidiary switches. Furthermore, he feels that it is most important to have the branch switches in a position where they are not only easily seen (so that the various heats are ascertainable at a glance) but so placed that they are readily operated. Switches, in his view, are best located on the wall behind the cooker—in fact, everything possible must be done with the electric-cooker to render the prevention of waste an easy matter. An oven thermometer, too, is an essential in the author's experience. On the subject of shrinkage, he makes some sensible remarks. He says it is impossible to give a fixed figure, the same as some electrical enthusiasts do from ancient records and modern electrical assumption. "If there is much fat," says Mr. Cooper, "the loss will be heavy; whereas if the joint is lean, the loss will be much less." "Further, the actual figure obtained, judging by the author's experience, *depends upon the temperature, not upon whether the system is electric or otherwise, except possibly to a minor extent.*" That is precisely what we have been saying all along; and the point has been carefully evaded by electricians, though (to suit their book) the contrary assertion has been persisted in. Cooking in a coal-heated oven, Mr. Cooper obtained losses, with rolled ribs of beef, ranging from 18½ per cent. to 29½ per cent.; with electric cooking, at "normal" temperatures, the losses with rolled ribs of beef ranged from 12½ up to 20 per cent.; and with the temperature "too high" in the electric-cooker, the losses were 23½ and 24 per cent. The difference between "normal" temperature and temperature "too high" was about 50° Fahr. The author deprecates extravagant claims in this matter, adding: "For example, in a technical article not so very long ago, it was stated that even 'if gas were provided free of cost, it would still be far cheaper to cook by electricity' on account of the saving in the meat. Such a statement is absurd. . . . It is forgotten that the roasting of joints is but a small part of the total cooking." Mr. Cooper passes on to the consideration of the questions of shock, and troubles with flexibles; and he urges that the station engineer should make himself responsible for the earthing of electrical apparatus, and see that it is effectively carried out. So keenly does he feel on this matter that he suggests that the Council of the Institution of Electrical Engineers should draw up rules as to earthing; that they should discriminate between apparatus that should, and that should not, be used in the kitchen; and that they should specify the character of flexibles to be employed for radiators and other apparatus. There follow the warning words: "The author feels that, if some such step is not taken and pressed home vigorously, electric cooking will suffer materially in the same way as electricity in mining has suffered through want of earlier control." The paper is a good one; and we acknowledge the very evident desire of the author to be fair, and the freedom of the paper from extravagant assaults upon competitors. Mr. Cooper's idea apparently is that, if electric cooking cannot rise on its merits, then nothing will prevent its fall.

NOTES FROM WESTMINSTER.

Parliament rose last Tuesday, and will not reassemble before the middle of April. There are only two or three matters arising out of the Dewsbury Bill worth special mention this week.

Calorific Power—The Responsibility of the G.L. & C.C.

In connection with the new calorific standard, the responsibility will rest upon the Gas Light and Coke Company of seeing that the apparatus and conditions prescribed by the Metropolitan Gas Referees are the "most suitable" to ascertain the maximum heat value of their gas. If the Company do not do this, it appears that, according to the present situation of things, there will be no protection for gas undertakings coming under the model calorific clause—in other words, if apparatus exists or is hereafter devised which will give to gas a higher return than that prescribed by the Metropolitan Gas Referees, and if the Gas Light and Coke Company do not insist upon having this apparatus, it will be a disadvantage to other undertakings. In the Gas Light and Coke Company's Act of last session, it is provided that "the apparatus to be prescribed by the Gas Referees for testing the calorific power of the gas supplied by the Company shall be the most suitable for ascertaining, and in making the test shall be used in such a manner, and under such conditions, as to ascertain, after any necessary calculations have been made, the total heat value of the gas." This gives to the Company the right to have at all times the most suitable apparatus prescribed for bestowing upon the gas its full due in the matter of thermal value. But the model calorific clause simply requires the provision of "apparatus for testing the calorific power of the gas supplied . . . similar to the apparatus for the time being prescribed by the Metropolitan Gas Referees for testing the calorific value of gas." This being so, all concerns under the model clause will have no right of appeal, so long as the apparatus is that prescribed by the Metropolitan Gas Referees, even though the apparatus may not be the most suitable in existence—at any time in future—for ascertaining the total heat value of gas. The Dewsbury Corporation (whose Bill was before the Local Legislation Committee last week) did not desire to be bound by the prescriptions of the Metropolitan Gas Referees; and so they proposed in their Bill that the apparatus provided by them for testing calorific value should be the "most suitable for ascertaining the total heat value of the gas." But the Committee decided in favour of the terms of the model clause, and so bound the Corporation to the prescriptions of the Metropolitan Gas Referees. It will therefore rest upon the Gas Light and Coke Company to see that, if apparatus comes along more suitable than that prescribed by the Referees for ascertaining the maximum heat value of the gas, advantage shall be taken of it.

Prices in Outside Districts.

When outer areas are incorporated in districts of gas supply, it is customary to charge a price—at any rate, for a period—so many pence higher than that obtaining in the "inner" area. The addition, of course, is for the purpose of meeting the extra distribution and working expenses. A ruling was given in the Dewsbury case last week which shows that Parliament does not like agreements for fixed gas prices in outer districts, and prefers that maximum excess prices be prescribed—say 4d., 6d., or 8d.—above those in the "inner" area. This assures what the fixed price will not do, that the outer areas will enjoy the benefit of reductions, and can also be made to share in necessary increases. The finding of the Committee was that the existing long-period agreements the Dewsbury Gas Committee have made, with fixed prices, should not continue more than ten years, and then the excess or differential form of charge will have to come into force. Gas undertakings upon this expression of parliamentary preference will in future make their bargains with outside areas not on a fixed price basis, but on an excess charge upon the ordinary price in the home district.

Purchasing Crude Gas.

The Middlesbrough Corporation last year obtained powers under which they are purchasing coke-oven gas, and utilizing it for town supply purposes. A similar clause to the Middlesbrough one is included in the Dewsbury Bill. It appears that certain collieries in the neighbourhood carbonize a semi-waste coal product; and the Corporation are proposing to buy up the gas, and to distribute it for trade purposes The gas industry is helping to provide economy for the manufactories of the country.

Evolution of the Gas-Engine.—At a joint meeting of the Staffordshire Iron and Steel Institute, the Birmingham Metallurgical Society, the University Metallurgical Society, and the Birmingham Section of the Institute of Metals, recently held in the University of Birmingham, Professor H. Hubert, of the Ecole des Mines, Liége, delivered an interesting lecture on "The Evolution and Recent Progress in the Design of Large Gas-Engines, more especially dealing with Large Continental Blast-Furnace Gas-Engines."

EVENT AND COMMENT.

[**Communicated.**]

Toluol Recovery Plants.

In these notes a fortnight ago reference was made to the adoption of toluol recovery plants on gas-works and coke-oven plants, and it was implied that the Government had overlooked the coke-ovens as a source of supply much more important than the gas-works. As is well known, toluol is recovered to some extent along with benzol in connection with bye-product coking; and the writer suggested that the Government were not making the most of the plants already existing before extending the recovery to gas-works. The writer was personally aware that no direct communication had been made with several coke-oven owners; but Mr. Macintosh Williams, the adviser to the Committee on the Supply of High Explosives, in this connection writes to point out that, though no direct communication has been made with such owners, the buyers of crude benzol are in touch with the Government, and hence the supply of toluol is being controlled. Mr. Williams says:

> With regard to persons producing crude benzol or crude naphtha, it was realized that such crude benzol, &c., was bound in the end to get into the hands of rectifiers who made either commercial or pure toluol, and would therefore come to the War Department as such; and it was not considered necessary that special arrangements should be made regarding such crude benzol. But with regard to these contracts, as it was the desire of the Secretary of State for War not to interfere with any contract for either commercial or pure toluol where this article was finally going into the hands of a maker of trinitro-toluene, all persons who entered into contracts with the War Department were permitted to finish the contracts which already existed on their books, provided the War Department were satisfied as to the final destination of the stuff.

The writer is glad to be able to correct any misapprehension which may have arisen as a result of the previous note. He would, however, mention that the resources of coke-oven plants are apparently not being entirely utilized; and the point still remains that these could be more easily and economically dealt with than by erecting recovery plants on gas-works. At many benzol plants in this country where crude benzol is manufactured, in order to keep the strength of the benzol at 65 per cent.—the recognized usual selling strength—a moderate quantity of other products, condensing at a temperature of about 90° to 95° C. and upwards, is separated, and is run-back into the scrubbing oil. This latter in time becomes more or less saturated; and then these products remain in the gas. Is it not likely that such condensates contain some toluol? If they do, it would be a very simple matter to collect them and extract any toluol. Without in the least casting any reflections on anybody concerned in the matter, it seems fairly obvious to coke-oven people that the resources of the coke-ovens have not been utilized to their fullest extent. A sample of the above-mentioned product tested by the writer distilled 18 per cent. at 125° C., distillation commencing at 70° C.

Efficiency.

When prices are low and costs are high, much more attention is paid to all-round efficiency in coke-oven plants than at other times. Efficiency is after all only normal conditions, and normal conditions mean careful checking of waste. A very good instance of what could be done was mentioned by Mr. Lee in his recent address. He showed how the efficiency of a gas-engine had been increased 17 per cent. by merely controlling the composition of the exhaust gases by frequent analyses. In another case also given by Mr. Lee, much economy had resulted by the introduction of CO_2 recording apparatus in connection with a boiler plant. There is room for similar apparatus in connection with bye-product coke-ovens, both with the ovens themselves and with gas-fired boilers. It is usually assumed that with regenerative ovens of a good type, only about 50 per cent. of the total gas produced is required for heating the ovens; but in very few cases is any trouble at all taken to check this. It is quite a simple matter to control gaseous combustion by means of gas analyses. An excess of air is as much to be guarded against as an excess of gas; for in either case the highest efficiency is not being attained. CO_2 recording apparatus, used in the proper manner, would immediately indicate any variation from the best conditions. The same argument applies also to gas-fired boilers. At many collieries, old-fashioned types of burners are still employed; while at others (although newer burners are installed), so long as the gas burns and steam can be raised, no further trouble is taken. By means of a little attention and regulation—again coupled with flue-gas analyses—in many cases a saving of from 10 to 50 per cent. could well be effected. The initial outlay for recording apparatus would be repaid many times over in twelve months. Gas analyses generally are only too frequently neglected and ignored on coke-oven plants. By controlling the analyses, much help is derived in getting the best out of the plant.

A frequent trouble on many plants is the deposition of pitch in the gas collecting (or hydraulic) and conducting mains. One of the principal causes of this is the overheating of the mains, thereby causing the tar which is circulated to be distilled, the lighter oils passing forward with the gas, and the pitch remaining sticking to the main. The deposit gradually accumulates, and may eventually lead to a complete stoppage of the main. If such stoppage does occur, it is both an expensive and a difficult matter to remove it. The overheating of the main is often caused by the admission of

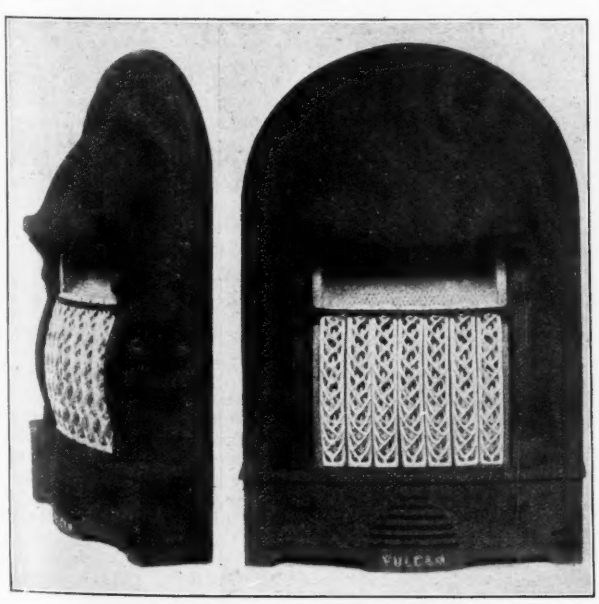
air into the ovens during carbonization, due either to running the exhauster at too high a speed, or to bad luting of the doors, or both. The air so drawn into the ovens burns up both some of the coal and some of the gas, and raises the temperature very considerably. In a short time, the heat passes to the ascension-pipes and then to the gas-main, finally bringing about the trouble with pitch. Frequent gas analyses would immediately indicate whether or not an excessive amount of air was being drawn in. Determinations of carbon monoxide, carbon dioxide, and nitrogen should therefore be made very frequently. Here a CO_2 recorder would certainly be very useful.

Although the gas-engine has increased in popularity as a power-producing medium in recent years, the attention which has been paid both to gas-burners, boilers, &c., and the improvement of steam-engines, turbines, and also the fuller utilization of exhaust steam has tended to give a longer lease of life to steam plant. There is, of course, no question that with a given amount of gas from the power point of view alone, the gas-engine is much more economical than the steam plant. Against this has to be set the fact that the gas-engine plant is more expensive both to buy and to maintain; and, moreover, it is neither so reliable nor so well understood by the average workman as is steam plant. Most modern coke-oven plants employ a lot of electrically operated machinery; and where it is a case of merely making current for their own consumption, it is an open question whether steam or gas plant is the more suitable. It is a matter not only of pounds, shillings, and pence, but other factors come in as well, especially reliability and convenience. Where there is a possibility of making a large central generating station at which electricity is produced for distribution over a considerable area—in other words, where a large quantity of power will be required and at an approximately constant and high load—then it would seem that the gas-engine station is to be preferred. In Germany, many such stations exist, where large quantities of both coke-oven and blast-furnace gas are consumed in gas-engines. Having decided on the type of prime mover, then comes in another question or two. Shall the units be large or small, and of the two-stroke cycle or four-stroke cycle type of engine? Consider a plant (say) of 10,000 H.P. Shall there be ten engines of 1000 H.P. each, or five of 2000, or four of 2500? There are arguments for both schemes. As far as reliability is concerned, there is little to choose. But supposing one large engine breaks down, there is a sudden increase of the load on each of the other engines. If a stand-by engine is provided, the capital charges are very heavy indeed. This is a question which must be considered carefully in each particular case. There are those who prophesy that the two-stroke engine is the engine of the future. Several are running on coke-oven plants in this country, and are giving every satisfaction.

The utilization of the heat contained in the exhaust gases from gas-engines is an absorbing problem, the proper solution of which will still further increase the advantages of a gas-engine plant.

A FIRE WITH CONVEX RADIANTS.

WALKING up the road from the railway station, in a heavy snow-storm and a razor-keen wind, just before sitting down to write this article, the thought of something like a "gas foot-warmer"



Side View. Front View.

Harris's Patent Convex Fronted Stove.

proved extraordinarily attractive. But, as a matter of fact, at any time when artificial heating at all is needed, it is more than likely to be one's feet that are first thought of—the general attitude of a person being apt to be governed by the consideration of ensuring warmth to this portion of the anatomy. With a fire so arranged as to project the greater part of its heat downwards and outwards on to the floor, of course, one's feet may, as it were, be left to look after themselves; and this is precisely the object aimed at, and secured, by the convex fronted gas-fire patented by Mr. R. P. Harris, of the Commercial Gas Company, and manufactured by the Vulcan Stove Company, Limited, of Exeter. This fire in its earliest form, it will be remembered, was shown at the National Gas Exhibition, at Shepherd's Bush; but since then Mr. Harris has devoted much further time and thought to his invention, with the result that several modifications have now been made.

First of all, as to the brick. This is so formed that it provides an unrestricted flow for the combustion products; but it is made convex, instead of the ordinary straight pattern, resulting in the radiant heat being projected downwards and outwards. The radiant is also of quite a new formation; being curved to follow the shape of the brick. It is designed wide at the mouth, and tapering to the top, so that the flame does not impart the bulk of its heat to the lower portion; the endeavour being to equalize it as much as possible. For the same reason, the burner-nozzles are brought forward out of centre. The arrangement of the radiant, too, is such as to impart a pleasing flame-like appearance; and it requires little time to get red. The aim in the construction of the burner has been to render it silent and easily detachable from the frame—there being no screws whatever; while the flame itself is thoroughly well oxidized. As to the special form of radiant, the extra cost of this, it may be remarked, is so small that the price is very little indeed different from that of the straight pattern.

The Curved Radiant.

But whatever might be the advantages of this construction of fire in other respects, it could, of course, not be regarded as a success unless its hygienic efficiency were above reproach; and after a thoroughly satisfactory demonstration of its capacity to throw great heat to the floor level of the room, the writer naturally turned his attention to the "products" aspect of the matter. On this point, Mr. Harris stated that, in the construction of the fire, it had been his desire that the result should be hygienic efficiency without the existence of a flue-pipe to carry off the hot products of combustion (attention being given at the same time to unnecessary loss of its heating properties in so doing); and that in this he had succeeded. As a proof of the correctness of his assertion, the well-known "Lancet" chemical test was thereupon applied, which showed that the result claimed had, under reasonable working conditions, been attained. In order, however, that the matter might be placed beyond all possibility of question in the future, it was suggested to Mr. Harris that he should, as other gas-fire makers have done, send one of his stoves to the "Lancet" to be tested by them; and this, so sure was he of his ground, he at once eagerly consented to do. Since then, the "Lancet" have had a fire under test, with the result that Mr. Harris has received the following gratifying report: "The fire comes through the hygienic test quite satisfactorily. That is to say, there is no leakage of combustion products into the room, even without the elbow."

The illustrations show that the fires are made with a casing of neat design; and connection can be made on either the right or left hand side. There are already a few out on the Commercial Company's district; and as they are giving satisfaction, it may be safely assumed that their number will soon be added to.

A WEIGHTLESS SLIDING PENDANT.

A VERTICAL sliding pendant without the need for having balance-weights, wheels, and chains attached to it, and yet capable of being adjusted to meet varying loads, is a highly convenient gas-fitting, which at the same time offers ample opportunity for artistic design. The fitting is available, in the "Best" weightless sliding gas-pendant; and the makers—Messrs. Best and Lloyd, Limited, of Birmingham—have, in their profusion of beautifully designed goods, the fullest opportunity afforded them for applying the device to handsome and graceful styles of fittings, suitable for all situations. The patented arrangement which thus permits the combination of the elegant slimness of the rigid fitting with the

useful character of the height-adjustable one, is withal extremely simple and effective.

The principle on which the fitting works is that of the sliding tube being gripped by a spring. When the sliding tube is pulled downwards, the spring automatically tightens its hold; and when an upward pressure is exercised, the grip is as automatically released. The action is, it may be remarked, secured by means of two springs. The outer spring, which is loose in the casing of the rod, has a V-shaped opening with sharp edges; and the inner spring, which is gripping the sliding tube, has also an opening similarly shaped, with edges turned outwards. When the sliding rod descends, bringing with it the inner spring, these turned-out edges engage in the V of the outer spring, the sharp edges of which exercise a lateral pressure on the edges of the inner one, increasing its grip upon the sliding tube. A stuffing-box above the springs renders the slide gas-tight; and there is effective provision for compressing the packing, should this become necessary through much use of the slide. There is also a spring regulator. By turning this to the right, the grip of the spring is increased, to carry a heavier weight; and by turning it to the left, the grip is slackened, for lighter weights. As for the simplicity of the idea, when once the fitting is arranged to suit the weight of the sliding parts concerned, nothing further is needed in the way of adjustment, with the exception of the possible compression of the packing just referred to.

One Pattern of the "Best" Weightless Gas-Slide.

The invention has already been applied to a number of the firm's fittings in different finishes; and it can be adapted to practically all their designs of one, two, or three burner shade lights or gas-pendants. Reference has been made to the combination of the utility of the adjustable fitting with the attractive appearance of the fixed one; but there is, particularly nowadays, another quality needed, and that also is supplied by this device. The movement is a very smooth one; and when the pendant is properly handled, there should be no fear of damage to mantles or glasses. Thus the "Best" weightless sliding pendant would appear to have a field of real usefulness open to it.

CITROËN GEARS.

WHEN describing recently in the "JOURNAL" the plant installed for pumping purposes in connection with the Aldershot Water-Works, it was stated that in the newer pump-house there are four sets of direct-driven deep-well pumps, each of a capacity of 20,000 gallons per hour, operated by horizontal gas-engines, and that three of them are fitted with Citroën gear. Inquiry elicited the facts that this gear is remarkably quiet in action, and, though high in initial cost, amply justifies its introduction by the saving in wear and tear and smoothness of turning moment, due to the extreme accuracy of the machining. In a photograph of the machinery which appeared on p. 583, the gear can be seen clearly on one of the pumps.

Returning to the subject for a minute now, it may be pointed out that double helical gears (the teeth of which consist essentially of two single helical teeth opposed to each other) were devised with the double object of securing silent running and of obviating axial thrusts; and the Citroën method of cutting them, with one tool, in one operation, from the solid, with a suitable angle of inclination, overcomes all the difficulties experienced as a consequence of the earlier modes of production. It is therefore claimed that it is the finest device for the transmission of power. High efficiency is secured, owing to the continuous engagement, the theoretically correct shape of the teeth, and the choice of an angle of inclination of 45° for the two spirals. At the same time, total absence of back-lash, shocks, and vibration result in noiseless running; and this silence is obtained without the sacrifice of either strength or durability, both of which qualities the gear possesses to a marked degree. The continuous engagement secured renders it possible, also, to cut pinions with a minimum of four teeth; and for this reason wheels of high-ratio gears can be kept within reasonable size.

It was in 1901 that the first machines for cutting these gears were laid down in a small works near Corbeil, in France; but three years later a move was made to Paris. Subsequently, a British branch was opened, which has now been formed into a separate Company, with sub-offices in the principal towns, and agencies in certain of the Colonies. The gears for all these parts are made at the present extensive modern factory in Paris, which was opened in 1911; and other portions of the world are served from factories in Russia and Austria. In the seven years that have elapsed since the establishment of the first office in London, it is said that the word "Citroën" has become almost a household word among engineers; and the Company feel that they can be justly proud of the name, inasmuch as wherever it is pronounced it conveys the impression of quality.

The particulars given here are taken from an album *de luxe*—prepared in a manner which amply warrants its title—issued by the Citroën Gear Company, Limited, of 27, Queen Victoria Street, E.C., which describes the method of manufacture of these gears, and the reason why they give such good results. There are also included a number of illustrations of typical installations in connection with the transmission of power for a variety of purposes. Among these are noticed water-works pumping, electrical, and compressing plants. There is, further, a section devoted to "Useful Information," which is intended to be of assistance in imparting to those interested a more detailed knowledge of the gears.

LECTURES ON GAS-HEATING, &c., AT HANLEY.

Domestic Hot-Water Supplies.

A SERIES of practical lectures, under the auspices of the County Borough of Stoke-on-Trent Gas Department and the British Gaslight Company, Limited, was delivered by leading authorities on the various subjects, on March 3 and 4, in the British Gaslight Company's show-rooms at Hanley. The first lecture, on "Gas-Heated Boilers for Domestic Hot-Water Supply: Their Practical Application," given by Mr. Frederick Dye, M.R.I., the head of the Hot-Water Department of Messrs. John Wright and Co., was attended by, among others, a large number of the staffs of the various gas undertakings in the district.

The lecturer commenced by discussing the cost of heating water by gas, speaking firstly of the more or less theoretical figures sometimes advanced, afterwards showing how several common conditions make it unwise to work too closely to these calculations. While, for example, there may often occur actual instances of a warm bath being obtained at a cost of less than 1d. (which laboratory tests, with efficient apparatus, always show to be possible), yet in actual practice heat losses from uncovered pipes and other conditions will very often make the cost 1½d. In the same way with high-temperature water for dish-washing, tests will show that ten or twelve gallons can be had by burning a penny-worth of gas, yet local conditions will often be such that the cost may be appreciably increased.

But though a fairly liberal margin be allowed for the cost of heating the water, even this does not admit of much waste; and in relation to this the lecturer gave a very convincing idea of the important purpose served by the thermostat, or automatic gas-valve. Attention by hand, at the gas-tap, even by a careful and interested person, always fails to eliminate waste when unassisted by automatic control. If the attention at the tap were that of a servant, it would in practically all cases prevent the boiler being retained in the house. Of course, this would not be the boiler's fault; but it is always the boiler that is blamed. A demonstration of the action of the thermostat was given, showing how precise and instant, and constant, the action is; so that it can be relied upon that waste will never occur by inattention.

The lecturer then dealt with the more practical aspect of the subject—the fixing of the boilers and the work associated with fixing. The keynote of this section of the subject may be said to be that while a boiler may have a high efficiency, and every other quality a boiler should have, satisfactory results largely—almost wholly—depend on proper connections and the absence of faulty details in the hot-water system. These points were entered into in considerable detail, showing particularly that the boiler-fitters' responsibility does not end with the proper fixing and connecting of the boiler, but that, when introducing a gas-boiler, he must see that faults already existing in the piping system in the house will not prevent the boiler showing what good duty it can do. The faults commonly met with, and the simplest means of remedying them, were clearly described.

An interesting discussion followed.

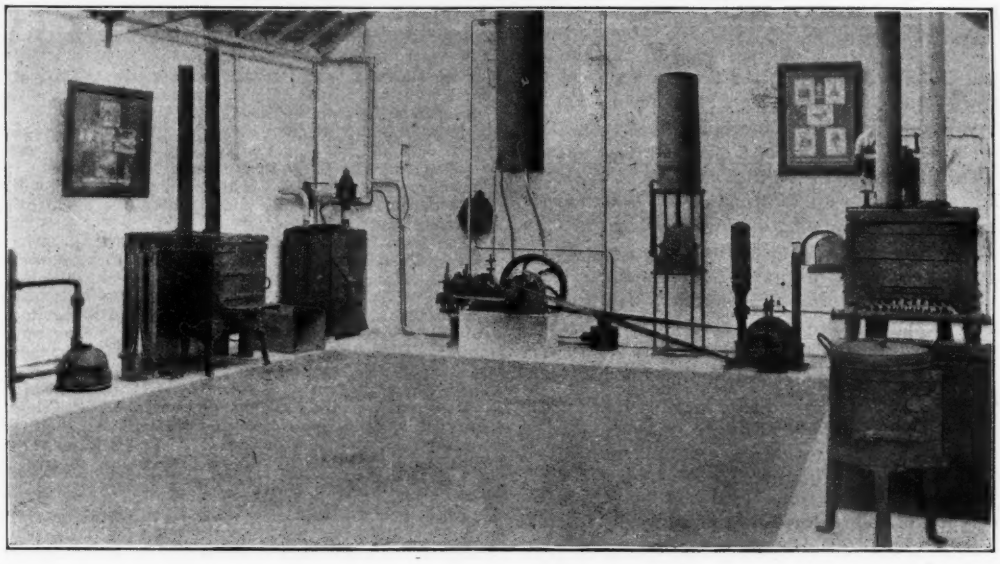
Modern Gas-Fires.

In the evening the lecture was on "The Modern Gas-Fire," and was delivered by Mr. Arthur Forshaw, M.Sc. Mr. Harold Copp, the Engineer and Manager of the Hanley works of the British Gaslight Company, Limited, was in the chair.

The lecturer first of all took up the question of radiation and convection—the proportions between the two forms of heat—and indicated its great importance, as all modern gas-fire practice depended for its success on the proper appreciation of this question. He went on to describe the effects of convected heat, and showed that the capacity of air for moisture is really doubled for every 20° Fahr. the temperature is raised. He also mentioned that the saturation in a living room should lie between the limits of 65 and 80 per cent.

In discussing radiation, which as a mode of transference of heat, he described, Mr. Forshaw said that it was not possible to design a heating apparatus which could give either all its heat in the form of radiant heat or all in the form of convected heat, and that, as a matter of fact, a certain amount of primary convection from the gas-fire was desirable so long as it was low-temperature convection. Of course, the radiant heat eventually manifested itself as secondary low-temperature convection.

He then went on to describe the older types of gas-fire and their



Furnace Room, British Gaslight Company, Hanley.

disadvantages, and said that perhaps their only good point was their economy, in that they recovered a great deal of heat in the form of convection. When it was recognized that high-temperature convection must be got rid of in favour of radiation, the problem was, while doing this, to still maintain economy; and he mentioned the various inventions by means of which this end had been achieved, as, for instance, the shallow and wide-fire principles, the adoption of the columnar radiant in place of ball "fuel," the abolition of the fuel guard, &c.

He then went on to describe the modern gas-fire and its characteristics. He said that a thermometer is no criterion of comfort, and that, while the old fires gave hot air, notwithstanding that the walls and furniture were cold, the new fires give cool air, though the walls and furniture are warm. Fires built on these lines had justified themselves by attaining a remarkable and widespread popularity. Mr. Forshaw said it was perhaps necessary to utter a warning with regard to making a fetish of radiation, and that it was undesirable to make fires with small radiating surfaces, giving off a highly concentrated radiation, as such fires had their own peculiar discomforts, and that anything which was likely to militate against the spread of gas-fires would defeat the object of those interested in gas—namely, the supersession of the coal-fire by the gas-fire.

Perhaps the most important direction in which the gas-fire had, until quite recently, fallen short of the coal-fire had been in that of the ventilation it afforded. Perhaps the only objection on the part of the public to a great number of modern gas-fires was that they did not provide sufficient ventilation. It was the recognition of this insufficiency which had led to his firm introducing their well-known "injector-ventilating" fires, the action of which was described and illustrated by means of figures and diagrams, showing the greatly superior ventilation afforded by the "injector-ventilating" fires.

After a full treatment of this part of the subject, the lecturer went on to discuss the question of chimney up-draught and down-draught. The latter constituted an almost universal trouble, particularly in hilly districts and in coast towns. By means of sketches he showed the causes of down-draught in many cases, and suggested means for its cure.

At the end of the lecture, Mr. Forshaw gave a demonstration of the smoke test used in their laboratories for detecting escapes of the products of combustion. It was a very simple test; no apparatus beyond a small pepper caster being required, and this could be carried about by any fitter, and used *in situ*, in cases where down-draught was suspected. Of course, in their laboratories they only used it on rough testing. For the more exact work, they relied entirely on air analysis.

The Chairman and Mr. W. Langford, the Chief Engineer and General Manager of the Stoke-on-Trent Gas Department, and a number of other members of the audience took part in the discussion.

Warming Rooms and Buildings by Hot-Water.

At the third lecture, on "Warming Rooms and Buildings by Hot Water," delivered on March 4, Mr. Harold Copp again presided. The subject was divided into two parts by the lecturer —Mr. Frederick Dye; the first being a description of different systems or methods of installing the piping, while the second part dealt with gas-boilers, as applied to the warming of buildings, the work they can do, and the amount of gas taken to do it.

Examples were given of the "two-pipe system," which is the older of the systems now in use, the "one-pipe system," and the "overhead system." In each case both advantages and failings were described, though it was pointed out the choice of the system to be adopted must depend upon the conditions presented by the room or building to be warmed. For instance, neither of the first two systems lent itself to satisfactory work when the boiler had to stand on the same floor-level as the radiators, &c.

The more vital part of this lecture was perhaps that which dealt with the cost of the warmth when obtained from gas-boilers. The lecturer frankly pointed out that it was necessary to be careful to apprise the consumer when there was a prospect of gas heating costing much in excess of coke, as it may sometimes do. Broadly, it was stated that with fair-sized to large installations, doing continuous duty, coke was the cheaper fuel; yet there were a good number of such installations worked by gas-boilers—the users being willing to pay any extra cost in order to gain the distinct advantages that gaseous fuel offers. With small installations—like those of garages, small conservatories, billiard and other single rooms, &c.—the gas-boiler did not show a high comparative cost for fuel, chiefly because the small coke-boiler is not so economical as the larger sizes, and there is also the question of attention. As is widely known, the gas-boiler for these small requirements is very largely used with entire satisfaction.

The lecture was concluded by a description of the gas steam radiator, with details of its parts, and of the many uses to which it is now so widely put.

Gas-Heated Furnaces.

The last lecture, given in the evening on March 4, was attended by a number of students from the Stoke School of Science and Technology, and many distinguished local scientists, including Dr. J. W. Mellor and Mr. Bernard Moore. Mr. W. Langford was Chairman on this occasion.

This fourth lecture was delivered by Mr. Shipley N. Brayshaw, M.I.M.E. It dealt with the subject of "Gas-Heated Furnaces," the substance of which has already appeared in these columns in a recent article dealing with the Sheffield Furnace Exhibition. An exceptional degree of interest was lent to the lecture by a number of diagrams which were displayed and fully explained by the lecturer.

Considerable discussion ensued at the close, in which a number of those present took part.

Constitution of Peat Tar.

In the distillation of peat for the purpose of utilizing the heat and extracting nitrogen, there is produced tar, the precise nature of which has not been defined. Herren E. & F. Bornstein have, it appears, examined this product, and fractional distillation gave the following results:—

	Per Cent.
Water	48·5
Product boiling at 150° to 170° C.	1·8
,, ,, 170° ,, 230° C.	4·7
,, ,, 230° ,, 270° C.	10·7
,, ,, 270° ,, 330° C.	24·7
Residue (coke)	9·4
Gas and loss	0·2

Applying the usual methods to the products from the distillation of 1 kilo. of tar to extract phenols and alkaloids, the following results were obtained: Phenols, 18 per cent.; alkaloids, 1 per cent.; oils, 34 per cent.; pitch (paraffin), 47 per cent. Applying directly to the tar the methods of extraction with alcohol ether, 24·1 per cent. of paraffin was obtained; its melting-point being 65° C. (149° Fahr.). Peat tar could consequently be profitably utilized for extracting paraffin and vaseline oils; and probably also the superior phenols, existing in abundance, might be usefully employed for the preservation of wood, or for the derivatives they yield with formaldehyde, or in the form of nitro-derivatives.

SOCIETY OF BRITISH GAS INDUSTRIES.

The Annual General Meeting of the Society was held last Thursday, at the Trocadero Restaurant, Piccadilly Circus, W. Being on active service, Sir Alfred Keogh, K.C.B., LL.D., could not preside. Mr. J. W. Broadhead, the retiring Chairman of Council, occupied the chair until the time arrived for the elevation of Mr. F. Templer Depree to the position. Later on, Mr. J. H. Balfour Browne, K.C., D.L., who was President in 1910, kindly attended, and resumed the presidential duties during the reading of the Chairman's (Mr. Depree's) address and a paper by Mr. R. J. Milbourne, as well as at the dinner. His presence again among them in the old position gave much pleasure to the members, who were present in excellent numbers. There were also several guests from the Institution of Gas Engineers (including the President, Mr. John Bond), the District Associations, and the British Commercial Gas Association.

At the business meeting, the minutes of the meetings held last year were first confirmed.

Report of the Central Council—The War and Business.

The annual report of the Central Council was next presented. The following are the main points:

In presenting the ninth annual report, your Council are of opinion that the past year has probably been the most trying in the history of our industry. The declaration of war on Aug. 4, 1914, undoubtedly caused a great dislocation and upheaval in business and finance—eased, however, by the prompt measures adopted by the Government to deal with the situation.

The edict issued by the Local Government Board to corporations and district councils not to spend money on new schemes if the same could possibly be put off, and to avoid every expenditure that could reasonably be postponed, created a serious outlook for many of the members of the Society. Fortunately, however, gas is a public necessity, and constantly increasing in demand for all purposes, which increase has, of course, to be provided for if our trade and industries are not to be interfered with. So that, in spite of dear money, increased cost of raw materials, and higher wages, the industry has been, and continues to be, fairly well employed.

As regards the increased cost of apparatus here referred to, it is the strong conviction of all gas apparatus manufacturers that prices are bound to still further increase for materials, and that even after the war is concluded it is questionable whether they can ever come down again to those of the pre-war period. It will be of interest to all to state that this was the general opinion of a conference held in January between a Committee comprising members of the Council of the Institution of Gas Engineers, the British Commercial Gas Association, and this Society. The members of the Society elected to attend the joint conferences were: The Chairman, Vice-Chairman, Messrs. F. J. West, G. H. Pearson-Perry, H. M. Thornton, H. James Yates, and Samuel Cutler, jun. The conference was held to consider the question of the Government assisting gas companies to raise new capital. It was felt that this subject was rather a difficult one, and resulted in the President of the Institution of Gas Engineers being deputed to seek an interview with the Board of Trade officials on the subject.

Our members have, in many cases, had to carry on business under exceptional difficulties through inadequate railway and shipping facilities; railways and ports being at times closed against all traffic for long periods, due to the requirements of the Government in moving stores and troops, to general congestion, shortage of rolling stock, lorries, horses, and, of course, men. The great struggle in which we are now engaged is naturally claiming the supreme attention of the whole industry; and the patriotic response of our members and their employees to the call of their country in this its hour of need is most satisfactory.

Your Council have pleasure in again recording continued progress, and a further increase in membership; the total now being 122 firms. They, however, feel that all members ought individually to use their influence to bring in those firms who are eligible for membership, and thus ensure the continued success of the Society.

The Council, with great regret, record the death of Mr. Thomas S. Clapham, of Messrs. Clapham Bros., Limited, of Keighley, an Elective Member of the Council, who passed away while in active work on Feb. 15, 1915. He was one of the founders of the Society, and had served on the Council since its inception—occupying the position of Chairman in 1912-13. His sound judgment and tactful advice have contributed in no small degree to the present satisfactory position of the Society.

The Society's subscriptions to the British Commercial Gas Association amounted to in 1912 £2115, in 1913 £2289, and last year £2378. Subscriptions for the current year are now due; and members who have subscribed for the past three years will have recently had a circular from the Secretary asking for renewed and increased support for the Association. Your Council feel that every member of our Society who has subscribed cannot but be satisfied with the way in which the money has been spent for the purposes intended. The Association is undoubtedly doing a great work to popularize and extend the use of gas for the benefit of both gas undertakings and gas plant and appliance makers. Your Council therefore earnestly ask all the members to subscribe to it—thus supporting what has become for the industry a beneficial, in fact a necessary, organization. It is hoped that a generous response will follow this appeal.

Certain alterations of rules are next dealt with; and then there is reference to the conference held during the year between the Institution of Gas Engineers and a Committee of the Society with reference to the gauging of gasholder sheets and plates, also the rolling margin to be allowed. The Council consider the result [see "Journal" for Dec. 1 last, p. 469] quite satisfactory, and one removing a long-felt hardship under some specifications.

At a meeting of Section V. held in May last, it was decided to appoint a deputation to confer on the question of the life of gas-meters with a Committee of the Institution of Gas Engineers. Several meetings have been held, and it is hoped that much good will result.

Section VI. have under consideration the standardization of the threads of gas-fire fittings.

The financial position of the Society continues to be satisfactory. There is a slight excess of expenditure over income—accounted for by contributions to the Prince of Wales's and Belgian Relief Funds.

The Society desires to record its best thanks to Professor Harold B. Dixon, Ph D., F.R.S., for his able and most interesting Presidential Address delivered at the last annual general meeting, and to Mr. J. W. Broadhead, M.I.Mech.E., for his address, as Chairman of the Council, at the half-yearly meeting.

Sir Alfred Keogh, K C.B., LL.D., who at the present time is holding the important position of Director-General of the Army Medical Service, has kindly consented to continue as President of the Society for another year. Owing to his official duties, he will, however, be unable to deliver his Presidential Address at the annual meeting; but this will be looked upon as a pleasure deferred.

The Chairman (Mr. Broadhead), in moving the adoption of the report, said it was not a lengthy one; and it did not reflect or indicate the large amount of work which had fallen to the lot of the Central Council during the past twelve months. The members little thought when they met twelve months ago that, before the next meeting, England would be plunged in a Continental war of a magnitude unparalleled in the world's history, and one which would require of those countries which were Allies every effort and the exercise of every resource if to a successful conclusion was to be brought the battle that they were fighting for the cause of freedom against militarism and naval aggression. They all trusted and hoped that the end of the awful war would result in a lasting peace, never again to be broken in the shameful and arrogant manner in which it was last August. Since the report was issued, the Treasury had circulated some stringent regulations with regard to the issue of fresh loans and the raising of fresh capital by undertakings, and more particularly with regard to local or municipal concerns. In many instances quite recently they had absolutely vetoed loans for extensions considered by the different authorities to be of a necessary character. This was a very different state of affairs from what they expected when war was declared. It was then the impression that business was to be carried on as usual; and they were even given to understand that, if necessary, the Government would afford assistance to the local undertakings in the raising of new loans at suitable rates. In this connection, he should like to mention the conference that took place last January between the Institution of Gas Engineers, the British Commercial Gas Association, and the Society, with the view of approaching the Board of Trade to see if facilities could not be afforded to enable authorized gas undertakings to raise new capital on a suitable basis. The outcome of the conference was expressed in a letter from Mr. Dunn, the Secretary of the Institution. It read as follows:

March 16, 1915.

Government Aid to Statutory Gas Undertakings.

Dear Sir,—Referring to the discussion of the above by the Joint Committee, consisting of representatives of the Institution, the Society of British Gas Industries, and the British Commercial Gas Association, I have to inform you that Mr. Bond, as requested, laid the matter before the Board of Trade in an interview with Mr. Graham Roper.

A reply has been received, stating that the Board of Trade has been in communication with His Majesty's Treasury with regard to the suggestion raised—viz., that the Government should grant loans at a reasonable rate of interest to those statutory gas undertakings which are faced with the necessity of extending their undertakings—but that the Board regret that they are unable to hold out any expectation of assistance being granted by the Government in the manner suggested.

—I remain, &c.,

(Signed) Walter T. Dunn, *Secretary*.

Arthur L. Griffith, Esq.

They hardly expected a reply different from the one they received. Undoubtedly the Government's line of action was found to be the necessary one. The Government had told the country that this war was going to be won with silver bullets. They would all have to bow, with the best possible grace, to the inevitable; but, of course, the decision of the Government created a bad outlook for all the members of the Society during the course of the war. The resolution to restrict expenditure would probably fall very heavily on some of the members, particularly those who were not able to turn their energies in the direction of the manufacture of munitions of war. Meantime, it behoved the members to draw closer together, with a view to rendering the best possible account of themselves when the time came for the recuperation of the nation. Much in this direction would depend upon the foresight exercised by the leading industries of the country. At the last half-yearly meeting, the death of their late President (Mr. Thomas Newbigging, D.Sc.) was feelingly referred to. Now the saddest part of the present report was undoubtedly the allusion to the death of the late Mr. Thomas Clapham, who was elected a member of the Council at the very inception of the Society, and always took

deep and active interest in it. All present that day missed his genial presence and countenance. The Council, on their own behalf and that of members generally, sent a vote of sympathy to his family and firm; and it was his (Mr. Broadhead's) mournful duty, as the Chairman of the Council, and as a personal friend, to pay his last respects to his memory by attending the funeral. He asked the members to silently rise to confirm the action of the Council and their expression of sympathy. While speaking of the Society's losses, he was sure every member present would be very sorry to hear of the death of Mr. John Carter, Gas Engineer to the Lincoln Corporation. He was a gentleman who always had a very kindly thought for members of the Society and manufacturing engineers in particular. He often used the eloquence with which God gifted him in furthering legitimate objects of manufacturing firms. With the permission of the members, he (the Chairman) would ask the Secretary to send a suitable letter to his widow, expressing their deep sympathy. The British Commercial Gas Association was suitably referred to in the report; and all the members recently had a letter from their Secretary, reminding them of the fact that subscriptions for the present year were now due. The Council looked forward with great confidence for a very hearty and continued support of the Association, who unquestionably were doing much good for gas undertakings and manufacturers of gas plant and apparatus. The proposed alterations of rules which would be moved presently had been before the members since the last half-yearly meeting. All he would say about them at this stage was that, if passed (as he had no doubt they would be), they would tend to enhance the prosperity of, and harmonious feeling in, the Society. He had the pleasure a few months ago of introducing representative delegates from the meter-makers to representatives of the Council of the Institution of Gas Engineers. He must say he was extremely pleased with the cordial reception the Institution representatives gave them; and from the manner in which the many different subjects that were unfolded at the meeting were being dealt with, he was satisfied that nothing but good could result from the investigations that were taking place at the present time—not only good for gas undertakings but for the manufacturers of gas-meters. He was sure they were all pleased to find that their statement of affairs continued satisfactory. Since the report was issued the membership had increased by one. They were all exceedingly sorry their President was unable to be with them that day. A surgeon-general of His Majesty's Forces had great claims upon his time just now, so much so that he had not a spare moment. It was difficult to please everybody at times; and no doubt the Council had not pleased some members by deciding that they should have their annual dinner and entertainment that evening as usual. The Council took the matter into serious consideration; and their decision was a unanimous one. People had to eat; and they might as well eat together. There was no doubt about it, too, that caterers and entertainers had been as hard hit by the war as any section of the community.

Mr. F. J. West seconded the motion, which was adopted.

Shortage of Railway Waggons.

Mr. Broadhead said there was one matter upon which they as manufacturers felt very keenly at the present time, and that was the subject of railway transport. While they did not object to the Government commandeering trucks and closing lines for military purposes, what they did object to was seeing goods trains running along the lines with empty waggons which might be filled with merchandise. They also saw empty trucks standing idle in sidings, simply because one company's waggons could not run over another company's lines—the Midland trucks, for instance, were not allowed to run over the London and North-Western lines. They as manufacturers thought that the railway waggons ought to be pooled as if there were no railway company's name on them. This would automatically do away with a lot of the congestion that was experienced at the present time. They saw trains brought into stations, the goods discharged, and then sent away empty, though the station might be crowded with goods for districts through which the waggons, belonging to other companies, had to pass. He hoped that the pressure that had been brought to bear by the traders on the Railway Clearing House and the Government would have a beneficial effect. He was sure if the railway waggons were pooled, a great deal of relief would result.

Financial Statement.

Mr. James W. Wilson moved the adoption of the financial statement for 1914. He thought the result of the year's working had been quite satisfactory, seeing that, though they were in war times, the expenditure only exceeded the receipts by £9 10s., which was due to their generosity in making subscriptions to various funds.

Mr. F. J. Gould seconded the motion, which was carried.

The Central Council.

The Chairman announced the names of the Chairmen of the various sections, who constitute the Central Council. They will be found in the complete list appearing a little later in the report.

The New Chairman of Council.

The Chairman said the time had now arrived for him to vacate the chair. Before doing so, he should like to say how proud he had been of the position the members conferred upon him twelve months ago. He had had a very happy year into which would always be crowded many pleasant recollections. It had been one, he trusted, of continued progress of the Society. He had had during the year the undivided support of every member of the Council, as well as of every member of the Society, for which he thanked them very heartily. Now it was his privilege to nominate for election by the members the new Chairman; and he submitted with the greatest possible pleasure the name of Mr. Templer Depree, who had taken a great interest in the Society from its inception, particularly so since he came on to the Central Council, where they were always pleased to have his observations and advice. They were always useful. Mr. Templer Depree was a Justice of the Peace. He had taken an active interest in public affairs. He was an Alderman of the City of Exeter, and a Sheriff of the County of the City of Exeter. He would be the first Chairman to combine both the heavy and the light sections; and he (Mr. Broadhead) was sure he would discharge the duties of the Chairman of the Society with credit to himself and with satisfaction to the members.

Mr. F. C. Tilley seconded the motion, which was adopted.

Mr. F. Templer Depree, on taking the chair, thanked the members for the kindly way in which they had received the nomination, which he regarded as being evidence of the support they would give him during the twelve months he would have the pleasure of presiding over the Council. He appreciated very much the honour conferred upon him. It was not a Society with a great length of service behind it; but he questioned whether there had been any other Society formed in modern times that had gained the same amount of stability, grown with the same rapidity, and done the same amount of useful work in a corresponding period to the existence of this Society. Ever since he had been a member of the Council, the amount of attention that body had given to the affairs of the Society, and the amount of support rendered to the Council by the members generally, were sufficient to make anyone very proud of being elected Chairman. He was afraid he would have difficulty in carrying out the work in the way the late Chairman had done, because he was in every sense of the word highly efficient. But if the effect of doing the best he could would be to win the approval of the members at the end of his term of service, they should have the best service that his ability could provide.

The New Vice-Chairman and Other Office-Bearers.

The Chairman said he had now to propose as Vice-Chairman for the ensuing year their friend Mr. H. M. Thornton. He was sure the nomination would meet with the approval of the members. Personally, he felt exceedingly fortunate in having Mr. Thornton to work with him as Vice-Chairman during the year. They knew what an immense interest Mr. Thornton had taken in the work of the Society, and they knew of the work he was doing at the present time on behalf of the gas industry. Many of them had the pleasure of listening to his paper before the British Commercial Gas Association on the modern uses of gas for industrial purposes, and only the previous evening he was addressing the Royal Society of Arts on the same subject.

Mr. Thos. Glover seconded the motion, which was agreed to.

Mr. Thornton thanked the members for his election, and said that he was particularly glad to be serving in association with Mr. Templer Depree.

Mr. H. James Yates moved the appointment of Mr. T. A. Braddock as Hon. Treasurer, in place of Mr. Thornton.

Mr. H. J. Donkin seconded the motion, which was carried.

Mr. Braddock having acknowledged the election,

On the proposition of Mr. S. Cutler, jun., seconded by Mr. A. P. Main, Mr. Cyril G. Davis was re-elected Hon. Secretary.

Mr. Davis acknowledged the confidence of the members.

The Chairman proposed as an elective member of the Council Mr. J. W. Broadhead. He remarked that in electing from time to time as elective members of the Council those gentlemen who had assisted so materially, as Mr. Broadhead had done, in carrying on the work of the Society, they were doing a wise thing, as in this way they did not lose their services. There was a strong desire that there should be a constant infusion of fresh blood into the Council. This was being arranged for; but they had several instances of gentlemen who had devoted a large amount of time and attention to the work; and they did not want, after they had gone through office, to lose their services altogether.

Mr. R. J. Milbourne, in seconding, said that, following on the remarks the Chairman had made, he thought it very desirable that the rules should be amended so that in future the retiring Chairman should automatically have a seat on the Council. He should be glad to give notice to bring this matter forward at the next meeting. Mr. Broadhead had rendered valuable service; and it would be much against the interests of the Society were they to lose his services.

The motion was unanimously carried.

Mr. Broadhead having returned thanks,

Mr. W. D. Helps proposed, and Mr. W. A. Drake seconded, the election of Mr. Percy F. Holmes as an elective member of the Council.

Moved by Mr. B. B. Waller, and seconded by Mr. C. A. Goodall, Messrs. H. James Yates and W. D. Helps were elected elective members of the Council.

Proposed by Mr. H. M. Thornton, and seconded by Mr. H. D. Burn, Messrs. Cash, Stone, and Co. were appointed Auditors.

A Brief Resumption of Presidential Duties.

At this stage, Mr. J. H. Balfour Browne, K.C., D.L., one of the Past-Presidents, took the chair.

List of Office-Bearers.

With the foregoing elections, the register of office-bearers stands as follows:

President.

Sir Alfred Keogh, K.C.B., LL.D.

Vice-Presidents.

Dugald Clerk, D.Sc., F.R.S. — Sir Corbet Woodall, M.Inst.C.E.
J. H. Balfour Browne, K.C. — Prof. H. B. Dixon, Ph.D., F.R.S.
Prof. Arthur Smithells, F.R.S. — Charles Clare.

Central Council.

Chairman: Alderman F. Templer Depree, J.P.
Vice-Chairman: H. M. Thornton, J.P., M.I.Mech.E.

W. P. Gibbons	representing Section	I.
R. J. Milbourne, Assoc.M.Inst.C.E.	" "	II.
Samuel Cutler, jun.	" "	III.
T. V. Miles	" "	IV.
Thomas Glover	" "	V.
James W. Wilson	" "	VI.
F. C. Tilley	" "	VII.
T. E. Upjohn	" "	VIII.
Sir Kenneth Crossley, Bart.	" "	IX.
G. H. Pearson Perry	" "	X.
George Clark	" "	XI.
R. B. Hodgson	" "	XII.
H. James Yates, F.C.S., M.I.Mech.E.	*Elective Members.*	
William D. Helps	*Elective Members.*	
J. W. Broadhead, M.I.Mech E.	*Elective Members.*	
Percy F. Holmes	*Elective Members.*	
Cyril G. Davis, *Honorary Secretary.*	*Ex-officio Members.*	
T. A. Braddock, *Honorary Treasurer*	*Ex-officio Members.*	

Secretary: Arthur L. Griffith.

Revision of Rules.

Proposals were then introduced by Mr. Broadhead to amend the rules, so that new blood should be infused into the Central Council through the elections and retirements.

The adoption of the amendments having been moved by Mr. Broadhead, and seconded by Mr. G. H. Pearson-Perry, they were unanimously agreed to.

A BRIEF REVIEW OF TEN YEARS' EXPERIENCE OF THE GAS INDUSTRY AND PROGRESS DURING THE DECADE 1904 TO 1914.

The Chairman of Council (Mr. F. Templer Depree) then read the following address:

In departing, as I intend to do, from the general form that addresses at these meetings have hitherto taken, I may perhaps be forgiven if, instead of addressing myself to some technical point, I say something of what I have seen and known about the gas industry during the last ten years.

History of the Society.

Rather more than ten years since—viz., in December, 1904—the "Journal of Gas Lighting," in a leading article entitled "A Suggestion for Consideration," drew attention to the desirability of forming an institute of gas-works contractors and manufacturers. It seemed revolutionary at the time; but, as we now know, it was very sound. It asked for the formation of an institution where contractors and manufacturers of those materials on which the gas industries depend, might meet together.

The gas undertakings of the world were great even then. They are greater now; and we, who manufacture everything but gas itself, began at that time to claim close association between their work and ours—between the engineers who produce the gas and men who arrange about its distribution and use. The suggestion was almost immediately acted upon; and Mr. Charles Clare, the Chairman of the Exhibitors' Committee of the Earl's Court Gas Exhibition, which was then just closing, sent out notices of a preliminary meeting to be held in the Exhibition. We rarely now have the pleasure of Mr. Clare's presence and assistance at our meetings, where he would be at all times welcome; and we all very much regret his absence.

In common with a number of others who were summoned, I attended the preliminary meeting, and well remember—new as I was at that time to the industry—feeling surprised that so few representatives were there. Few manufacturers thought it worth while even to attend and discuss the formation of our Society. Please remember I am telling the story of ten years ago. Our numbers were few; but though I happened to be part of the gathering myself, I claim that the material was good. At any rate, it did something definite, for fifty or sixty gentlemen met soon afterwards, under the chairmanship of Mr. Charles Clare, and formed a concrete scheme. That scheme was found good; and many who listen to me will remember how Mr. Fred. West later on explained all the objects of the Society in 1910. At the initial meeting, Mr. A. L. Griffith was appointed Secretary—a post that he has filled with great ability ever since.

The first meeting* of the Society was held in March, 1906, when a paper was read by Mr. C. E. Brackenbury, who took for his subject "Contracts and Specifications." Just about that time, if I remember rightly, we had some difficulties with the Press. There is no need to turn back to this old controversy. Suffice it to say that the Press and the Council of our Institution know one another better now. As a journalist has lately said, "Be interesting and you shall have a good report." Now I claim that we have always been interesting, if only the Press had known about us. They are realizing it now, and we on our side have broken down our old dreams of professional secrecy.

The first President was Mr. Dugald Clerk, F.R.S., who presided at the autumn meeting in November of that year, when a paper was read by Mr. Walter Thomas, of Liverpool, on "The Uses of Gas." Perhaps just about this time electricity had begun to tickle us up; so Mr. Thomas gave a new stir to our Society by explaining the mutual advantages to the public and to the manufacturers of gas apparatus that could be got by making a working arrangement with the gas companies. The first annual dinner was held at the meeting presided over by Mr. Dugald Clerk. The following month, an evening was devoted by the Royal Sanitary Institute to a discussion on the hygienic aspect of gas fires and stoves for heating buildings.

The annual meeting of the Society took place the following year, in February, when Mr. Dugald Clerk delivered his Presidential address, on "Possible Improvements of British Patents." In the autumn of that year, Sir George Livesey suggested that a department should be formed at Leeds University, and that a professorship should be established to deal with the subject of "Fuel, Solid and Gaseous." In October of the same year the formal opening took place of the Gas Exhibition at Manchester (which celebrated the centenary of gas lighting in that city). Some valuable comparisons were made at that time, which may not be without interest now, as they embraced a larger number of years than those now under review,* going back twenty years from the time I am speaking about. The capital employed in the industry of gas manufacture had increased from 48¼ million pounds sterling to 132 millions; the revenue, from £15,000,000 per annum to £30,000,000; the coal consumption, from 9 million to 17 million tons; consumers, from 8,000,000 to 22,000,000; and the length of mains from 20,000 to 30,000 miles—to a length that, if these mains were placed on end, they would wrap round the equator of the world 1¼ times.

February, 1908, saw the introduction of Sir George Livesey as President for the year. Sir George's business position, and the universal respect in which he was held by the gas industry generally, need not be referred to in a gathering of this kind. But I should like to remind you that, in stating his pleasure at accepting the presidency, he said he appreciated the high compliment paid him, he approved of the action of forming the Society because he believed it was right, and that it was not only of advantage to the gas industry, but might have a beneficial effect on industrial relations generally.

Ere the next annual meeting had taken place, the whole industry had to mourn the death of this great leader of the undertaking with which he was so honourably associated for so many years, and the usual autumnal meeting was not held.

In February, 1909, at the annual meeting, Mr. Thomas Newbigging was installed as President, and gave an address on "Claims and Criticism." He drew special attention to the foundation of the Chair of Gas Engineering established at the Leeds University, of which Professor Bone, F.R.S., was appointed chief. It was in Mr. Newbigging's year that steps were taken to endow this Chair by raising the sum of £10,000 as a memorial to the late Sir George Livesey. In the same year, also, another great reform was completed. Most of us know it, and some of us wonder why it was not effected years before. It was the formulation of a model set of contract clauses, approved by the Council of the Institution of Gas Engineers and the Society of British Gas Industries, which has done so much to remove the friction and discontent that previously existed.

The autumn meeting that year was held rather later than usual. The new President, Mr. Balfour Browne, K.C., was elected, and the retiring President read a paper entitled "Some Points for Consideration;" a second paper being read by Mr. Brackenbury, on "Legal Aspects of the Smoke Nuisance."

February, 1910, saw the induction as President of Mr. Balfour Browne. He chose as the subject of his address "Trade and Legislation," and drew special attention to the employment of British capital abroad, and the necessity of further and better representation of trade interests by legislative machinery in this country. At the autumn meeting that year, Mr. F. J. West, the Chairman of the Council, in his paper, dealt with the "Society of British Gas Industries: What it Has Done and What it Can Do." A capital discussion followed; and at the meeting it was announced that the Society now numbered over eighty firms (since increased to more than 120)—employing many thousands of men, and representing a capital of some £30,000,000! The announcement was also made by the President of his successor for the forthcoming year—Professor Arthur Smithells, F.R.S., of Leeds University.

The annual meeting of 1911, held in March, was a new departure for the Society, as it had been decided for the first time to go outside London; and, in honour of the newly-elected President, the Council met at Leeds, where they were most hospitably

* The following was the first Council of the Society:

Mr. Chas. Clare, Chairman.

Mr. W. P. Gibbons	Mr. John Mackay
Mr. T. S. Clapham	Mr. J. W. Wilson
Mr. F. J. West	Mr. Thos. G. Marsh
Mr. J. W. Broadhead	Mr. J. E. Williams

Mr. Charles Clare, Hon. Secretary } *Ex-officio* Members of Central
Mr. John G. Glover, Hon. Treasurer } Council.

* See appendix.

received by the Principal and Professors of the University. On the termination of the formal business, a very large number of the delegates were shown over the buildings. A close inspection was made of the Coal Gas and Fuel Departments, which were under the Livesey Professorship.

Professor Smithells, in his presidential address, entitled "Professors and Practical Men," spoke of the important part science and education now plays in the development of all branches of commerce; and how clearly this is demonstrated in the gas industry. At the same meeting a very interesting paper was read by Mr. T. G. Marsh.

In the autumn of the same year the Council decided to offer prizes to students sitting at the City and Guilds of London Examinations in "Gas Supply and Gas Engineering" (Honours Grade); thus carrying out a suggestion made at the previous autumnal meeting. In October (I am still speaking of the year 1911) a new organisation, which has been of astounding value to the gas industry was inaugurated. The British Commercial Gas Association sprang into existence, and has from that time forth continued to grow and flourish. But of this remarkable Association I intend to speak later.

The newly-elected Chairman at our autumn meeting was Mr. H. James Yates, F.C.S., who had the pleasure, as one of his first duties, of announcing the acceptance by Sir (then Mr.) Corbet Woodall of the presidential chair for the following year, and then availed himself of the opportunity to explain to the members of the British Gas Industries the aims and objects of the British Commercial Gas Association, and the benefits the one Society might be expected to derive from the other—views which I think we may say have been fully justified by results. At this meeting also the first mention was publicly made of the intention to hold, in 1913, the great National Gas Exhibition with which I deal later on.

The March meeting of 1912 saw a very much larger gathering than any that had gone before, and the retiring President inducted his successor, Sir (then Mr.) Corbet Woodall, into office. Naturally, considering his long association with the gas industry, no need of any special introduction was necessary to such a gathering. The labour world at that period was very much disturbed; and the address of the Chairman, the late Mr. Thomas Clapham, proved full of interest, and was dealt with in a manner worthy of the subject.

The 26th of June of that year saw the celebration by the premier Gas Company—the Gas Light and Coke Company—of their one hundredth anniversary, under the governorship of the new President of the Society of British Gas Industries, who was also, by a happy coincidence, President of the Institution of Gas Engineers and of the newly-formed British Commercial Gas Association.

How many of us who use gas to-day in a prosaic and commonplace way ever give a thought to the romance of its discovery. One hundred and more years have seen the marvellous development of the large and successful Company over which Sir Corbet so ably presides; but it is more than 250 years since an old Yorkshire cleric discovered, with the joy of a schoolboy, that a spirit or vapour rose from a pit near his house, and that if he applied a light it "burned like brandy." This old rector and a few other men of science, who burned bladders of gas for the entertainment of their friends were not to see the general benefit of their discovery, as more than another hundred years were to elapse before the practical use of coal gas as an illuminant was proved by Murdoch. In the year 1812, Murdoch's pupil, Clegg, lit up Westminster Bridge, to the "amazement of the public, and the disgust of the old lamplighters."

The autumn of this eventful year, 1912, was to see a still further striking example of the interest taken in the gas industry, when, at the invitation of the City of Manchester and the adjoining borough of Salford, at a meeting welcomed by the Lord Mayor of Manchester, the Right Hon. Sir W. (then Mr.) Royse, and presided over by Sir Corbet Woodall, more than 500 members of the British Commercial Gas Association assembled in the City Hall of Manchester. The success and wonderful enthusiasm that attended the meeting will, I am sure, remain quite fresh in the minds of those who had the privilege of being present. Sir Corbet Woodall's opening speech, when he so admirably foreshadowed the work of the British Commercial Gas Association, may well be quoted as the text of the Association. He said, "We are the heralds of a new birth in gas polity. We stand for unity in rendering our services to the community, and we know that what is best for one is good for all." He added that he believed that a central organization, concentrating all the interests of the 1600 gas companies, could be better managed than by allowing everyone of them to put up a feeble fight of its own.

The general autumnal meeting of our own Society was held in London, under the presidency of Sir Corbet Woodall. After an interesting paper on "Fire Clay" had been read by Mr. G. H. Pearson Perry, Mr. F. W. Goodenough explained the scheme proposed by the promoters of the National Gas Exhibition, and the advantage to be derived by all those associated with the gas industry. By the time the March meeting was held, many of the members of the Council who were serving on one Committee or another of the Gas Exhibition Executive were enabled to report favourably on the progress being made with what proved to be a very gigantic undertaking, and that the Society had come forward most handsomely as regarded financial support.

The Chairman had the pleasure of announcing that H.M. the King had conferred a knighthood on our President, and that the degree of Doctor of Science had also been conferred upon him and upon another ex-President, Mr. Thomas Newbigging, by the University of Leeds. Our first President, Mr. Dugald Clerk, had been similarly honoured by the University of Manchester; Professor Arthur Smithells had been elected a Member of the Council of the Royal Society; and Mr. Balfour Browne, K.C., had been appointed Honorary Treasurer of the Middle Temple.

The retirement of Sir Corbet Woodall saw the acceptance of the position of President by Professor Harold B. Dixon, Ph.D., F.R.S.; the chairmanship of the Central Council being taken by Mr. W. D. Helps. The President's address dealt with "The Immediate Problems of the Gas Industry," and proved most interesting and instructive.

As the year 1912 had been the centenary of gas lighting, so the year 1913 was to have its special Jubilee, by celebrating the fiftieth year of the Institution of Gas Engineers; and a meeting was held in Caxton Hall, Westminster, when the President, Sir Corbet Woodall, welcomed delegates from their own and kindred societies, including representatives from America, France, Belgium, Holland, and Germany, and a presentation of his portrait was made to Mr. Thomas Newbigging, with whom the conception of such an Institution originated.

So much has been written and said about the Gas Exhibition that I feel it is quite unnecessary to refer to it beyond saying that generally it was looked upon as being an unqualified success; and I believe gas companies, and consequently the manufacturers of plant and appliances throughout the kingdom, are to-day benefiting, and will for a long time to come benefit, by the publicity then given to the industry.

The autumn meeting of 1913 was held in November, and saw the induction as President of Professor Harold B. Dixon, and as Chairman of Mr. W. D. Helps; and it will be in the memory of all present how successfully both offices were filled, adding greatly to the reputation both of the holders of these offices and of the Society. Much interest was shown in the very original and stimulating paper of the Chairman, on "Thoughts by One Who Thinks." The announcement was made at this meeting of the fact that the Society had been fortunate enough to secure as their new President Sir Alfred Keogh, K.C.B., LL.D., M.D., the Principal of the Imperial College of Science and Technology. We are all aware of the reason of his absence from us to-day—namely, that he had been called back by the Government to undertake specially important military duties as Surgeon-General under the Secretary of State for War, work arduous both here and on the battlefield, in which we wish him every possible success.

March, 1914, brings us to the last annual meeting of the decade under review, and almost to the end of my remarks on the gradual growth, development, and, I think I may say, success of the Society of British Gas Industries. Professor Dixon made an important contribution to our technical papers, in his "Initiation and Propagation of Flames," which he accompanied by some particularly interesting experiments. He afterwards inducted his successor to the presidential chair. At this meeting the election was made of our respected Chairman, Mr. J. W. Broadhead, and several changes were effected in the Central Council, which, under the new rules of the Society, will be ever-changing—not with any idea of permanently parting with old friends (whose re-election is possible after twelve months retirement), but with a view, which is I think a correct one, that there may be a constant infusion of new blood.

Such is the story of our Society that has such a record of good work to look back upon; and I am proud (in the unavoidable absence of Sir Alfred Keogh) to preside over its tenth annual meeting to-day.

Ten Years of Progress in the Gas Industry.

Now I must turn to achievements that have been brought about in the last ten years by the gas engineers and the great business men who control the industry.

Ten years ago the competition for public lighting between electric light and gas, with the greatly increased impetus given to the latter by the introduction of high-pressure methods, reached a very acute stage. I have only to mention two special triumphs of gas to convince you that gas is winning all along the line. Put briefly, they are these. Buckingham Palace has preferred gas to electricity; the great London, Brighton, and South Coast Station at Victoria has been installed in the same way.

The details of these two installations are very interesting. At Buckingham Palace ordinary incandescent gas lighting was in possession; but improvment was wanted, and high-pressure incandescent gas lighting was decided upon. The change was effected by the Gas Light and Coke Company; and they are naturally very proud of the result. At the entrances, and along the railings, 28 lamps were fixed, disposed of as follows: On each pillar at the two Sovereign's gates, there are five lamps, arranged four in a circle, the central one raised above the others. The four lamps each contain one 500-candle power burner, and the central one two burners each of 500-candle power; so that these two gates account for 20 lamps. From each pair of pillars there is a light of 6000 candles, or 12,000 candles at the two gates. At each of the two ordinary gates, there are two 1000-candle power lamps; so that here we have accounted for four more lamps and 4000-candle power. Therefore, we have along the front of the Palace, from these 28 lamps, an illuminating power of 20,000 candles. One of the great features of the installation is that it all lights-up simul-

taneously as soon as the engine is started. A separate pilot light service is provided—it having been thought preferable to taking the gas for the pilot lights from the main service by the employment of valves. To have kept electricity from such a position is certainly a great success.

In the following year (1906) the Directors of the Brighton Railway Company had before them their own remarkable experience of the lighting of the old Victoria Station, in which they had effected a saving of no less than £1100 per annum, in addition to realizing a greatly improved illumination, by substituting ordinary pressure incandescent gas-lamps for electric arc lamps, supplied with current at about 2d. per unit.

The lighting of the new Victoria Station was eventually decided to be on the new high-pressure system. This method had been chosen in preference to the latest that electricity could offer. This in itself is a matter for the greatest gratification, seeing that, from beginning to end, it had been the aim of the Chief Engineer of the Company to incorporate in the station all that the vast experience of the past had proved to him as going to constitute a perfect London Railway terminus. Not far short of £2,500,000 was the estimated cost of this large work in railway engineering and building.

The general arrangements for the station do not concern us here; but a few particulars with reference to the lighting are of interest. The complete lighting of the station includes nearly 400 lamps, varying from 175 to 1000 candle power, and giving a total light of about 140,000-candle power. The gas is now supplied, under pressure, from the mains used for the lighting of the streets of Westminster; the compressing plant being situated at Horseferry Road. Again, this important work of installation was carried out by the Gas Light and Coke Company, under the personal direction of Mr. F. W. Goodenough, and is surely no mean victory for the old illuminant over its modern rival.

The High-Pressure Light.

From the point of view of the general public, perhaps no greater advancement has been made than the introduction of high-pressure gas lighting. I say, "from the point of view of the general public" advisedly, because the appearance of the high-pressure lamps in our streets with their bewildering flood of brilliant light, has compelled the attention of a usually unobservant public. I venture to assert that the high-pressure light is an outstanding triumph of the gas industry. Too long we have been told that the electric light was the most suitable for spectacular public lighting because of its great illuminating power; but now such assertions are seldom or never heard. One has only to see the magnificent lighting of the public streets and squares of many of our large towns and cities to realize that electricity has to face the competition of a brighter, softer, and more powerful illuminant. I have been interested, and very pleased, to observe that where in some of our towns and cities, a small section of one of the leading streets has been more lavishly and brilliantly lighted than the remainder, this section has always turned out to be the location of the gas company's offices and show-rooms, with a goodly array of gas apparatus for domestic use, tastefully and advantageously displayed to the public gaze. This is as it should be; and I commend the enterprise to others. Some time ago, a gas company in a medium-sized seaside town, who had lost the lighting of a sea promenade, boldly laid down a high-pressure plant, with mains in all the chief streets. They had not a single customer when they installed the plant, but, with praiseworthy confidence, they fixed gratis two fine lamp columns in the chief public square (by permission of the authorities), and put four high-pressure lamps on each column. Their success was instantaneous; and now every alternate electric lamp standard on the promenade is out of use, the other standards being displaced by the high-pressure light. Moreover in the first year 59 consumers were found who had lamps put outside their business premises. Thus does enterprise reap its reward!

It follows that for a high-pressure light to be a permanent success its cost must be low, the gas must be of the highest possible quality, and produced as cheaply as possible by the best and most rapid process.

The Vertical Retort.

The period under review has seen the appearance of the vertical retort, which has not yet reached its full development, but has certainly made rapid strides. It is a worthy seconder—on the part of the makers of gas apparatus—to the high-pressure light. Opinions may, and do, vary as to the best system of vertical retorts. Perhaps it is as well that they do; for healthy competition can always be relied upon to bring out the best in anything. Without, however, venturing on debatable ground, I think common opinion is that this new retort does displace a large amount of labour, gives a greater yield of gas per ton of coal carbonized, produces a more porous—hence more valuable and saleable—coke, with a proportionately similar increase in other residuals, and occupies less floor-space than horizontal retorts. I saw figures the other day relating to a new plant just installed, which were certainly very striking. The cost of carbonizing per ton was reduced from 2s. 9d. to 9d., the make of gas was 14,000 cubic feet per ton, against 11,380 cubic feet, the number of men required to work the plant was 4, against 24. I give the figures as received, and make no comment beyond this: If they are approximately correct (and I know of no reason why they should not be), the vertical retort is only just coming into its own, and, by sheer force of its superiority over the older methods, must win an abiding position in public favour.

Gas-Cookers.

Another noticeable advance in the past ten years has been the very large increase in the use of gas-cookers. The housewife certainly could not obtain a more useful and reliable servant at such a small cost. The popularizing of this useful domestic appliance is certainly due in very large measure to the demonstrations which are given in our large cities from time to time, and, further, to the commendable practice of having lady instructors at the disposal of any housewife, to explain the simplicity of the article, and, if necessary, to demonstrate by cooking some typical dishes.

Gas-Heating.

An even more striking characteristic of the decade under review has been the enormous increase in the use of gas-fires, which have improved greatly—alike in design, efficiency, and hygienic perfection. It is interesting to find, for example, that it is computed that 40,000 gas-fires are in use in Birmingham alone, which goes to prove that gas-fires have only to get over the prejudice against them (a prejudice largely based on ignorance), to come into their own. Medical men, at one time not too well disposed towards gas-fires, are now users themselves. The fires shown in the late exhibition were certainly of a high order—both in design and workmanship; and a modern gas-fire can heat a room more quickly and efficiently than coal, without in any way causing a stuffiness or dry heated air—indeed, the ventilation of the room is perfect.

A modern water-heater is one of the most efficient pieces of apparatus for providing really hot water for the cleaning of our houses and the cleansing of the human body that Britishers have ever known. Thousands of our countrymen wish they could have them in the trenches.

Above and beyond the supply of gas to houses, or even to palaces, we have made great strides in the way of heating furnaces, even to the highest temperatures desired by metallurgists; and we can regulate the daintiest possible flames over enamels.

Smoke Abatement.

The air of our large towns and cities would be infinitely purer if gas fires, cookers, and water-heaters entirely superseded coal-fires; and it is a matter of some wonder how much longer it will be before our authorities take away from a householder the right he now enjoys to vitiate the atmosphere by a smoky coal-fire, when a better and cleaner method of heating is provided. The unostentatious and truly patriotic efforts of the Smoke Abatement Society over which Sir William Richmond presides has not received at the hands of the public generally, or manufacturers in particular, anything like the recognition it deserves upon its hygienic, artistic, and economic merits. Perhaps at a time when economy is the national watchword, economy in our fuel supplies, and with it efforts for smoke abatement, will attract still more notice than they have hitherto. We in the gas industry can claim to have done our practical share in this direction.

We can, indeed, look back on ten years of striking progress in many directions. The large undertakings must, of course, lead the way in new enterprises which require heavy capital expenditure. It is encouraging, however, to know that progress is general in both large and small concerns, both in relation to the public and in works management. Never was such anxiety manifested to have the best of everything, never was a closer watch kept upon working expenses, upkeep of plant, and sale of residuals. The latter item is specially noticeable in small gas-works. In many instances the ammoniacal liquor was in the past allowed to run to waste, and the tar, when it could not be easily sold, deposited in the gasholder tank safely out of sight.

Coal Tar Dye-Stuffs.

In view of the great part played by tar for the supply of the chemicals which are used in aniline dyes for cloth, and the large subsidy given by the Government for the extraction of these dyes from gas tar in a factory to be put down in Great Britain, it behoves all companies, both large and small, to do their utmost, so that the factory, when completed, shall have large quantities of tar to draw upon, and thus ensure the success of the attack upon one of the largest industries which Germany possessed—an industry which ought to have been established in this country years ago.

Sulphate of Ammonia and Coke.

The Sulphate of Ammonia Committee, the London Coke Committee, and the Coke Committee recently appointed by the British Commercial Gas Association to deal with coke sales outside the Metropolitan area, will doubtless in the future, as in the past, contribute largely to the economic management of residuals, and to all those other economic results to housekeeping, farming, manufacturing, and so on, which must inevitably follow co-ordinated scientific management.

Exhibition Comparisons.

The autumn of 1904 saw the completion and opening of the International Gas Exhibition at Earl's Court—an undertaking on a larger and more complete character than anything of the kind ever attempted, and after an interval of twenty-two years since there had been a representative gas exhibition in this country—namely, that at the Crystal Palace in 1882. A further interval of nine years was to elapse before the exhibition of 1913 was to be placed before the public, on again quite different lines from either

of its predecessors. It is my object to draw some comparisons between the last two exhibitions, both as regards their methods and objects, and the relative results as affecting the welfare of the industry.

The international character of the 1904 exhibition can be judged by the presence of so many distinguished foreign delegates who attended the inaugural banquet to meet the Lord Mayor of London, held in the exhibition itself. France was represented by delegates from Paris and Lyons; Germany, from Hanover, Aix-la-Chapelle, Osnabruck, Hamburg, and Dessau [the form of interest taken by Germany in these islands lately has unfortunately been of a far less pleasant or profitable character—the latest attention bestowed by that country, with whom we had been for years on such friendly relations, being the destruction of one large gasholder and damage to two others at Hartlepool, as the result of the bombardment of the town last December]; Holland was represented by Rotterdam, Bois le Duc, and Antwerp; and our gallant Allies, the Belgians, by Brussels, Liége, Mons, Bruges, Tertre-lez-Badour, Schaerbeek, Verviers, St. Ghislain, and La Louviere. A delegate also came from Italy. Over 150,000 people visited the exhibition, and thus demonstrated the interest taken by the general public in the industry.

The evening banquet at the close of the proceedings further demonstrated the international character of the assembly by the presence of representatives of the overseas dominions—Canada and Australia. The Advisory Committee consisted of the following well-known gentlemen in the gas industry: Mr. Charles Carpenter, D.Sc., Messrs. Foulger, Goulden, J. W. Helps, Charles Hunt, D. Irving, A. W. Onslow, S. Y. Shoubridge, W. H. Y. Webber, and Charles Wood. Mr. Helps acted as the Honorary Secretary, and much of the success of the undertaking was due to the indefatigable and admirable way he carried out his duties.

The National Gas Exhibition of 1913 will still be fresh in the minds of most of us, and not need many references in order to bring home the complete success of the undertaking from a spectacular point of view, and the wonderful interest it created on the minds of thousands of people, and the enormous impetus which was undoubtedly given to the industry throughout the country, our Colonies, and the rest of the civilized world.

I had occasion to visit Australia and New Zealand in the early part of the following year, and was astonished to hear how the novelty of the plan as a trade exhibition appealed to the Colonists, and how much appreciation was expressed for the development of the industry. The list of patrons, presidents, and vice-presidents, headed by the King, Queen, and Princess Louise, was an extraordinary proof of the universal interest taken in the exhibit and the conferences held in connection with it; and the list of prominent officials, with Sir Corbet Woodall as President, Mr. Edward Allen, the genial President of the Institution of Gas Engineers, as Chairman of the General Committee, with Mr. F. W. Goodenough and Mr. H. M. Thornton as Chairman and Vice-Chairman of the Executive Committee, insured everything being carried out with thoroughness and success.

No reference to the undertak ng would be complete without special congratulations to Mrs. M. A. Cloudesley Brereton, the Chairman of the Editorial Committee of the Exhibition, who was responsible for much of the original scheme, for the excellent guide which gave such an admirable account of the whole undertaking, and also for the work of the expert staff which supplied specially prepared notices and news to newspapers and magazines throughout the country relating to the various exhibits and the scientific and other conferences held at the exhibition.

Ten years has seen the drawing together more closely of all the industries of the gas trade. The manufacturers and sellers of gas are now closely linked with the manufacturers of gas-making and gas-burning apparatus; and I venture to state that we have all mutually reaped a benefit. The publicity department, better known as the British Commercial Gas Association, under the chairmanship of Mr. Goodenough, and with Mr. W. M. Mason as its indefatigable Secretary, has done striking and yeoman service. It has consistently and persistently kept in front of the public the use of gas for a host of purposes, and placed it before the public by very ingenious and original methods.

APPENDIX.

COMPARISON OF RELATIVE MAKE, NUMBER OF CONSUMERS, NUMBER OF STOVES AND SLOT METERS IN USE BETWEEN THE YEARS 1904-5 AND 1914-15 RESPECTIVELY.

England.

	1904-5.		1914-15.
GAS LIGHT AND COKE COMPANY.			
Make, cubic feet	21,902,357,000	..	29,633,586,000
Consumers	406,032	..	774,913
Stoves	217,792	..	590,922
Slots	157,395	..	479,655
SOUTH METROPOLITAN COMPANY.			
Make, cubic feet	12,219,174,000	..	14,097,252,000
Consumers	259,676	..	369,731
Stoves	194,094	..	306,295
Slots	155,829	..	269,921

Scotland.

EDINBURGH.			
Make, cubic feet	1,913,649,000	..	2,141,177,000
Consumers	84,060	..	99,225
Stoves	6,463	..	30,155
Slots	4,497	..	12,650

Ireland.

DUBLIN.			
Make, cubic feet	1,612,981,000	..	1,618,368,000
Consumers	28,965	..	69,893
Stoves	10,554	..	49,702
Slots	10,765	..	53,352

Wales.

CARDIFF.			
Make, cubic feet	866,749,130	..	1,400,078,000
Consumers	19,776	..	39,003
Stoves	6,097	..	29,281
Slots	2,244	..	16,634

THE FOLLOWING ARE FURTHER COMPARISONS OF A FEW LARGE UNDERTAKINGS WHICH MAY PROVE OF INTEREST.

Southport.

	1904-5.		1914-15.
Make, cubic feet	428,280,000	..	586,687,000
Consumers	12,271	..	20,027
Stoves	2,723	..	9,302
Slots	2,053	..	5,960

St. Helens (Lancs.).

Make, cubic feet	376,448,600	..	555,162,400
Consumers	10,315	..	19,424
Stoves	7,509	..	17,960
Slots	6,658	..	15,988

Tottenham.

Make, cubic feet	895,334,000	..	2,475,390,000
Consumers	27,070	..	77,890
Stoves	4,696	..	47,776
Slots	15,450	..	55,754

Bournemouth.

Make, cubic feet	537,819,000	..	1,017,092,000
Consumers	13,206	..	26,232
Stoves	3,640	..	5,198
Slots	6,394	..	15,068

Plymouth.

Make, cubic feet	1,013,500,000	..	1,269,523,000
Consumers	24,000	..	35,218
Stoves	3,100	..	9,218
Slots	9,700	..	17,752

Bristol.

Make, cubic feet	2,344,629,000	..	2,967,651,000
Consumers	38,384	..	63,032
Stoves	23,084	..	51,520
Slots	8,890	..	29,071

The PRESIDENT (*pro tem.*) said they had listened to an exceedingly interesting address. The earlier part did not seem to him to lend itself to discussion. It was an exceedingly accurate and interesting review of the history of the Society. The reference to aniline dyes might possibly lead to some discussion, but he was not going to show the way. [Laughter.]

Mr. J. W. BROADHEAD said he rose with the greatest pleasure to move a hearty vote of thanks to their new Chairman for the able and interesting address with which he had favoured them. The address, however, was difficult to discuss, because it, generally speaking, dealt with matters of fact. It put upon record the history of the Society since its inception. He thought that, looking at this history, they would all agree with him that they owed a debt of gratitude to the "JOURNAL OF GAS LIGHTING" which first suggested the formation of the Society.* Their organization had accomplished much more good than ever they dreamed it would do when it was first formed.

Mr. H. M. THORNTON seconded the motion. They were, he said, indebted to Mr. Depree for having reviewed the work of the Society since its inception. Very often they forgot all that had happened during the years that had gone, and to refresh one's memory in this way was a good thing for them as a whole. The ten years showed how the spirit of co-operation had grown in the industry; and in it their Society had taken a no small part.

The motion was cordially passed.

The CHAIRMAN thanked the members for the cordial way in which they had shown their appreciation of his effort. If, he remarked, he had afforded them interest, and given them satisfaction, he was amply repaid.

A TRADE THAT MIGHT BE BRITISH.

Mr. R. J. MILBOURNE, Assoc.M.Inst.C.E., F.C.S., next read a paper bearing the above title. It appears, with a report of the discussion, on pp. 738-42.

This concluded the business before the meeting; but before separating, on the motion of the CHAIRMAN, a very hearty vote of thanks was passed to Mr. Balfour Browne for presiding.

ANNUAL DINNER.

In the evening the members dined together, Mr. J. H. BALFOUR BROWNE, K.C., D.L., in the chair. The vice-chairs were occupied

* The speaker mentioned a name in this connection; but, to remove any misconception on the point, it is well to put it on record here that the author of the article to which Mr. Broadhead referred, as did Mr. Depree in the course of his address, was Mr. Arthur F. Bezant.—ED. J.G.L.

by Mr. G. H. Pearson Perry, Mr. James W. Wilson, Mr. F. C. Tilley, Mr. R. J. Milbourne, and Mr. T. E. Upjohn. To the right-hand side of Mr. Balfour Browne, at the top table, were the Chairman of Council (Alderman F. Templer Depree), Mr. John Bond, President of the Institution of Gas Engineers, Mr. H. M. Thornton, Mr. A. E. Broadberry, Mr. H. James Yates, Mr. W. E. Price, Mr. F. W. Goodenough, Mr. Cyril G. Davis, Mr. S. Y. Shoubridge, and Mr. Samuel Cutler, jun. On the left-hand side were Mr. J. W. Broadhead, Mr. Robert G. Shadbolt, Mr. Fred J. West, Mr. John Young, Mr. William D. Helps, Mr. W. B. Farquhar, Mr. Percy F. Holmes, Mr. Octavius Thomas, Mr. T. V. Miles, and Mr. W. J. Rendell-Baker.

After dinner, there were two or three appropriate toasts.

Mr. Balfour Browne said he was pleased and proud to resume the position of President if only for an hour or two; but he was prouder at this juncture in their history to give the toast of "The King." The war had taught them many lessons. One was that to a great nation material prosperity was not the only goal. Another was that the age of self-sacrifice and heroism had not passed away. The third was that they should be more friendly one to another; and they were more friendly to their fellow-citizens. The fourth had taught them to be more loyal to their King and country.

The toast was drunk, and the National Anthem heartily sung.

Mr. Balfour Browne said the next toast he had to propose was "The Army and Navy." This would recommend itself without any words of his. Their Army—the Expeditionary Force, which was at first a mere handfull—had done great and heroic work. Their Navy had, without earning the plaudits of an admiring world, done an enormous service to the country. It had secured to the country the commerce which was necessary to the existence of the nation. It had crippled the industries of their enemies; and it had even shortened their food supply. At no time in history could this toast have been proposed with greater confidence; at no time or place in the world could it be received with greater acclamation than it would be there that night. This was a long and trying war. It was trying the nerves, it was trying the courage, of the people of this country. It was not over yet. But the people of this country had responded nobly to the call of duty; and although the country had not won in the past any great battles, although its record was greater than that of any other country, it had done more—it had created an Army which would win battles. [Cheers.]

The toast was honoured with much enthusiasm.

Mr. George Helps was called upon to respond. He said he did not quite know why he had been singled-out to respond to this toast, and particularly on an occasion and at a time like this. It seemed to him that the only proper way for men to respond to this toast was to pack-up, bag and baggage, and get away to the trenches. He did not know how many men there were present who were better able to fight than he was. If only his wind was a little better, he did not think he should be there that night. It seemed to him that a war like this demanded something of everyone. [A Voice: It is doing so.] He meant apart from the men, there was the action on the part of others that the men required. He did not think that at any time in the history of the country had there been any demand made that had been responded to in such a manner as the demands had been responded to in this great crisis. It had been his pleasure to serve as a volunteer in the rifles, in the naval auxiliary, and in the Yeomanry.

Mr. F. Templer Depree (the Chairman of Council) proposed the toast of "The Visitors." He need hardly say that at no gathering were the visitors more heartily welcomed than they were at the dinner of the Society of British Gas Industries. It was an extremely gratifying thing to him to learn from the gentleman whose name he was going to attach to this toast—that of the President of the Institution of Gas Engineers [applause]—that at no gathering did he feel more at home than at a meeting such as this of the Society of British Gas Industries. This was evidence that they were in good touch with their visitors; and evidence such as this was worth much. He remembered last year that his predecessor in the chair said that if the Society had only been started for the satisfaction of seeing guests at their annual gatherings, it would have justified its existence. They had, however, done more than this. They had not only the pleasure of seeing guests from the Institution of Gas Engineers, from the British Commercial Gas Association (including their friend, Mr. F. W. Goodenough), but they had assisted in tightening those bonds which had formed a triumvirate which had been to the essential good of the industry.

Mr. John Bond (President of the Institution of Gas Engineers) said he felt highly honoured in having to respond for the visitors on this occasion. He left Southport that day in a snowstorm, contrary to the wishes of his medical adviser, as he felt he would like to join the members of the Society in this more genial atmosphere. He had always taken great interest in the work that the Society had done, because he believed that behind it was the power for considerable good. He was not much accustomed to responding for visitors. Living as he had done for the past ten years in a place like Southport, he was more accustomed to toasting visitors. But on behalf of each and all of the guests present, he sincerely thanked their hosts.

After dinner there was an enjoyable musical entertainment, arrangements for which had been left in the capable hands of the Hon. Secretary (Mr. Cyril G. Davis).

Russian Equivalent Tables.—In view of the increasing importance of trade with Russia, the issue of information regarding the somewhat complicated Russian weights and measures, and especially of equivalent tables permitting of instant conversion of British weights, measures, and money into Russian and *vice versâ*, is of considerable interest to the trading community. The Central Translations Institute, Limited, of Danes Inn House, 265, Strand, has compiled from official figures a set of tables covering all ordinary commercial requirements, and has issued it, in the form of a folding card, at the price of 1s. net.

A TRADE THAT MIGHT BE BRITISH.

By R. J. Milbourne, Assoc.M.Inst. C.E., F.C.S.

[A Paper read before the Society of British Gas Industries, March 18.]

In response to the appeal made by our Chairman at the last meeting of the Society, I venture to submit this paper to the members, feeling that my efforts in compiling it will not have been in vain if the necessary interest that leads to effective action is aroused.

My subject may not appeal in detail to all sections of our Society; but I trust that it may be of special interest to the Chemical Section, and be the means of prompting a similar investigation into other trade sections represented in the Society of British Gas Industries. We are all ambitious to promote the trade of the gas industry; and whatever our individual opinions may have been in the past with regard to our free-trade system, we must feel under present circumstances that it is a duty we owe not only to the gas industry, but also to our nation, to take advantage of the present situation to secure as much of the trade of our enemy as we possibly can.

We have to consider carefully how, and in what direction, this particular object may be attained; and although it is my intention to deal with the trade and markets of the world in sulphate of ammonia only, there are other fields in which we must also make attacks if we wish to maintain and extend the commercial supremacy of the British Isles. Every day the war is prolonged Germany is gradually losing her over-seas trade, for neither export nor import can proceed while the British Navy and its Allied Fleets hold command of the seas.

Germany's Onslaught on Britain's Trade.

Within quite recent years Germany has made a vigorous onslaught on the trade of our country, which has seriously affected the firms represented by the members of the Society of British Gas Industries. German coal has been imported; fire-clay goods have been used extensively, and their assumed advantages and their professedly higher qualities over the productions of English manufacturers have been widely extolled; German cast-iron socket-and-spigot pipes, 4 metres long, have been for some time past in competition with our home foundries; and last—though certainly not least—the heavy section of the Society of British Gas Industries has had to submit to a threatened invasion of German gasholders. It is not my intention—much less desire—to introduce into the present paper any kind of political argument in favour either of Free Trade or of Tariff Reform; but I do contend that it is not in the best interests of English gas undertakings to purchase their requirements always in the cheapest foreign market. To the lasting credit of a large number of municipal authorities and gas companies throughout the country, their engineers have consistently embodied in all specifications for new work a special clause expressly stipulating that the whole of the materials and workmanship must be of British manufacture. Apart from this aspect of the subject—which may be considered by some as only a sentimental and patriotic view opposed to purely business principles—the English manufacturer has in the past been severely handicapped in competing with Germany, even for our home trade, owing to the valuable assistance German manufacturers have received from their Government to encourage and stimulate them in securing possession of the English market. It is now well known that German manufacturers have built-up their great industrial concerns largely on the support afforded them by the State and by their banks, which are always ready to finance sound propositions, and advance money solely on "orders in hand," or on the opinion of their expert advisers. I have, however, no hesitation in stating that with equal conditions we are fully prepared to enter into competition with Germany or any other country in the world.

In passing, it may be interesting to note that coal and iron are the main foundations of Germany's industrial development. Germany is very rich in coal, and, according to competent estimates, it is the European country in which the supplies will last longest—being more than twice those available in Great Britain. It is also interesting to note the view which Germans take of foreign trade. Theirs is a policy of exclusion, so far as their own country is concerned.

A Brussels newspaper last year published the ten commercial commandments drawn up for the Fatherland's faithful sons and daughters. They are worth reproduction here:

1.—In all your expenditure, however small, never lose sight of the interest of your fellow Germans and your Fatherland.
2.—Never forget that when you purchase a foreign-made article, even though it only costs a pfennig, you diminish the fortune of your country by your act.
3.—Your money should only profit German merchants and German workmen.
4.—Never profane German land, German houses, German workshops, by the presence and use of utensils or machinery made by foreigners.
5.—Do not eat imported food stuffs, which do a wrong to German agriculture, as well as injure your health, and are besides free from the sanitary inspection of German officers.

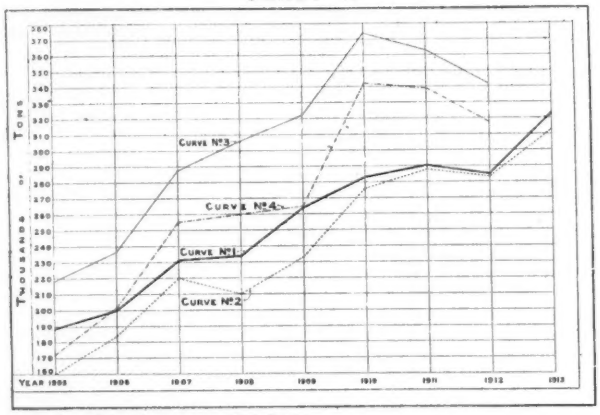
6.—Write on German paper with a German pen; and dry your German ink with German blotting paper.
7.—A German jacket gives distinction to a German's back; and a German-made hat is the only covering for a German's head.
8.—German flour and German fruit, German wines and German beer, can alone produce the German's power.
9.—Whether you drink coffee or chocolate, always see that it is the product of Germany or her colonies.
10.—When you are beset with foreign imitations, be convinced that the only products worthy to be consumed by Germany's sons are the results of Germany's trade and Germany's commerce.

The war in which we are now engaged will no doubt clear the ground of this unequal German competition. But these commandments furnish a most useful hint for Britishers, which I trust will be acted upon, as I have no doubt that there is one thing, and one thing only, that we intend to have "Made in Germany" by English and her allied workmen, and that is, "Terms of Peace."

Exports and Imports of Sulphate of Ammonia.

An examination of statistics from several sources, as to the exports and imports of sulphate of ammonia from the British Isles during the last ten years reveals some interesting and instructive facts. These can best be seen by referring to the accompanying charts.

CHART A



Curve No. 1 – United Kingdom's Total Exports
Curve No. 2 – United Kingdom's Exports less her Exports to Germany
Curve No. 3 – United Kingdom's Total Exports + Germany's Total Exports
Curve No. 4 – United Kingdom's Total Exports + Germany's Total Exports – Germany's Total Imports

Chart A is plotted and constructed from figures published by the Commercial Intelligence Branch of the Board of Trade. On this chart, Curve No. 1 shows that in nine years, commencing with the year 1905, the quantity of our exports to all places increased by over 70 per cent. The drop in the curve at the year 1912 is probably due to the coal strike that occurred during that period.

Curve No. 2 is plotted with the object of showing the effect on our exports during the years 1905 to 1913 inclusive, supposing that in some way we had been prevented from exporting sulphate of ammonia to Germany. This curve, when read in conjunction with Curve No. 1, distinctly shows that, generally speaking, up to 1912 the quantity of our exports to that country was diminishing. Even in 1913, though there was an increase on the previous year, the quantity exported by us to Germany represented only 2·88 per cent. of the total amount the United Kingdom exported. In 1912, the United Kingdom sent 1643 tons to Germany—a figure which represented only 0·57 per cent. of the total tonnage which our country despatched from its shores.

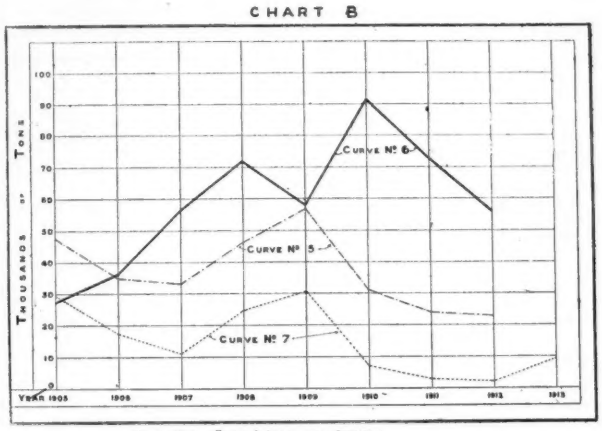
Statistics of Germany's exports are not available at the present time beyond the year 1912; and their absence for the year 1913 prevents the Curves Nos. 3 and 4 (Chart A) being continued beyond the year 1912.

On Chart A has been plotted Curve No. 3 to show the total quantity of this fertilizer exported by both Germany and the British Isles. The vertical distance between Curves Nos. 1 and 3 at any of the years indicated gives the number of tons of sulphate of ammonia exported by Germany. Curve No. 4 gives the total exports from the United Kingdom *plus* Germany's total exports *less* Germany's total imports; and a comparison between Curves Nos. 1 and 4 gives an indication of the maximum amount of trade that could have been captured from Germany in any one of these years.

It is interesting to observe that prior to 1906 Germany imported more sulphate of ammonia than she exported. This can be seen upon referring to Chart A (Curves Nos. 1 and 4), and again, but more pronounced, on Chart B (Curves Nos. 5 and 6).

On referring to Chart B, it is clear from Curves Nos. 5 and 6 that, generally speaking, German imports have decreased, whereas her exports have increased, although her exports between 1910-12 have decreased at a greater rate than have her imports. Also reference to Curve No. 7 unmistakably shows that the United Kingdom exports to Germany have been on the wane up to the year 1912; but there was a slight improvement in the following year. The curves on Chart B are taken from returns obtained from German sources. The curves on Chart A are made up of returns from the latter in conjunction with statistics published by the Board of Trade.

CHART B



Curve No. 5 – Total Imports into Germany
Curve No. 6 – Total Exports from Germany
Curve No. 7 – Exports from United Kingdom into Germany

Statement Showing How British Exports to the Following Places have been Generally Affected.

Name.	Increase.	Decrease.	Maintained Level.	Notes.
Foreign Countries.				
Germany	..	o	..	Up to 1912. Increased again 1913
Netherlands	..	o	..	..
Java	o	..	..	..
Belgium	..	o	..	Up to 1912, but phenominal increase 1913
France	..	o	..	..
Spain	o	..	..	..
Canary Islands	o	..	..	..
Italy	o	..	..	Up to 1912, but decreased in 1913
Japan (Formosa)	o	..	..	..
Malay States of				
America	o	..	..	..
Hawaii	o	..	..	..
Other Foreign Countries	..	..	..	..
Totals of above	o	..	..	..
British Possessions.				
Channel Islands	..	..	o	..
Mauritius and Dependencies	o	..	..	..
British West Indies	..	o	..	Slight
Guiana	..	..	o	..
Ceylon	o	..	..	..
Other British Possessions	o	..	..	..
Totals of above	o	..	..	..
Total (Grand)	o	..	..	..

This information is extracted from the Board of Trade returns issued in September last, and the statement shows the general tendency of exports of sulphate of ammonia from the United Kingdom and their destination to foreign and colonial buyers. It will be noticed that the *increases* preponderate over the *decreases*, with the result that the grand total to all places shows an increase. In those cases where decreases are recorded, it would be interesting to know the cause for the drop in trade; and this is a point which calls for investigation.

One of the most interesting facts revealed by the Board of Trade returns is that the United Kingdom's imports of sulphate of ammonia are so small as to be almost negligible. As a matter of fact, in 1912 only £700 (say, 60 tons or less) came from Germany—no doubt indicating that some member of the Fatherland, though resident in the British Isles, was religiously observing Germany's commercial commandments.

As showing the importance of sulphate of ammonia as a fertilizer, the exports of this commodity from the United Kingdom in 1913 represented 76 per cent. of the total value of manures exported.

In what countries, and to what extent in them, is sulphate of ammonia used? This is an interesting question, and the answer is revealed in detail by the Board of Trade returns compiled by the Commercial Intelligence Department.

These figures [p. 740] show there is over £700,000 worth of German trade in sulphate of ammonia open to capture; and it is worth an effort to obtain it.

On looking down the figures representing the value of exports from Germany, it is evident that Belgium takes a very large quantity—indeed, no less than 34 per cent. of Germany's total exports for the year 1912, while the Netherlands follow very closely. These two countries took, in fact, 66 per cent. of

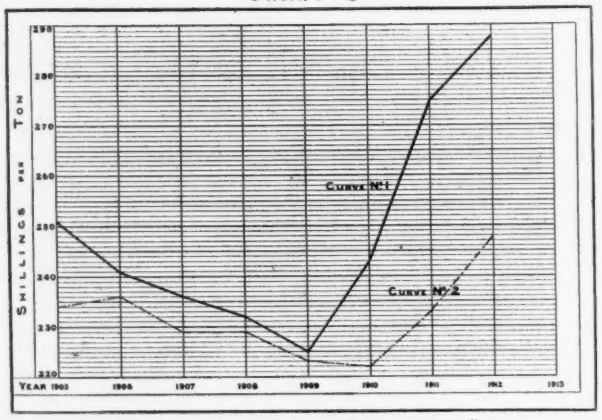
Sulphate of Ammonia.

Country to which Exported.	From Germany (1912).	From United Kingdom (1913).
	£	£
British India	600	3,500
Ceylon	1,500	29,600
Australia	200	..
Sweden	350	..
Denmark	900	..
Netherlands	223,800	39,100
Belgium	242,200	72,500
France	51,800	121,300
Switzerland	17,300	..
Portugal	2,000	47,600
Spain	11,100	718,500
Italy	46,500	80,700
Russia	200	600
Dutch East Indies	70,700	502,900
Brazil	12,500	1,800
Costa Rica	150	..
Mexico	2,000	2,400
United States	7,300	497,700
Total to above markets	691,100	2,118,200
Total to all markets	702,800	4,390,500

Germany's total export for that year. Our own sales to both these countries in 1913 represents only 2¼ per cent. of our total exports, and to Belgium alone only 1·65 per cent. Though Belgium cannot, through force of present circumstances, take sulphate of ammonia from us now, we ought to be fully prepared and ready to do business with her in this connection upon the cessation of hostilities, or as soon as the invaders of her territory have been driven out. Belgium will certainly favour our courtship of her trade; and it is "up to us" to step in and gain a firm footing in this particular country.

Other places, besides Belgium and the Netherlands, particularly deserving the attention of our traders are: Dutch East Indies, France, Italy, Switzerland, Brazil. There is every inducement to make a bold bid for these markets; and I venture to think that the British gas industry can in no way better serve our own country at this critical moment than by diverting orders from German to British channels and retaining them. We must realize that it is something more than a good stroke of business to extend our trade at the expense of our enemy. It is a patriotic duty, as by taking away the German trade we are inflicting a blow that must surely have a great effect on the progress of the war.

CHART C



Curve No 1–Average prices of Sulphate of Ammonia in United Kingdom
Curve No 2–Average prices of Sulphate of Ammonia in Germany

Let me call your attention particularly to Chart C, which gives the average price of sulphate of ammonia between the years 1905 and 1912. This Chart (Curve No. 1) shows our average prices f.o.b. Hull; while Curve No. 2 gives corresponding average prices in any of these years in Germany. The former is obtained from data published by Messrs. Bradbury and Hirsch, and the latter is derived from German sources; the data being published in the "Iron and Coal Trades Review" of July 3, 1914. [Parenthetically I should like to mention that the issue of the "Iron and Coal Trades Review" of the date just named contains information likely to be useful to other sections of our Society seeking particulars of German trade.]

Chart C indicates that German prices are consistently lower than our own, and reveals the surprising fact that, although the German manufacturer is willing to guarantee 25 per cent. of ammonia, with a correspondingly smaller percentage of free acid and moisture, our British manufacturers have received a higher price per ton for an apparently inferior article. The similarity of the curves on the chart referred to is striking, and the reasons of their close resemblance in form must conjure-up many thoughts about the commercial struggle for foreign trade between the United Kingdom and Germany.

It is reported that large quantities of sulphate of ammonia hitherto exported from the United Kingdom have not been equal in quality or condition, and have contained a somewhat lower percentage of ammonia than is usually supplied to foreign countries by Germany. It is complained that while the ammonia content of German sulphate is from 24¾ to 25 per cent., that from the British manufacturer is usually only in the vicinity of 24 per cent. Another complaint is that the free acid often reaches so high a percentage that cargoes despatched in bags not unusually arrive at their foreign destination practically in bulk, necessitating heavy and unexpected expenditure at the end of the sea voyage, with a consequent loss in weight and test. In these cases the bags have been completely destroyed by the excess of free acid and moisture.

This complaint as to the quality produced having been made on reliable authority, it would appear that in many gas-works the sole aim in the past has been to provide a sulphate irrespective of the varying percentage of its constituents. In some British gas-works the percentage of ammonia, free acid, and moisture is systematically checked by a member of the gas-works technical staff; but this is perhaps more often the exception than the rule. In a number of cases the working of the sulphate plant is left entirely to the sulphate man, whose intelligence or technical training extends only to the production of salt in the saturator and its removal therefrom to the sulphate stores.

It is perfectly evident that if we are to attain success in capturing German trade, we must be prepared to study carefully the requirements of the markets we wish to enter. This is one of the first essentials, which has apparently been neglected in the past, and furnishes a feasible explanation of the means by which Germany has managed to secure such a large share of the sulphate of ammonia markets of the world. It should be our aim to ensure that our prospective customers shall obtain from us a sulphate equal in all respects to the German standard, and not something which is merely a poor substitute. This is an exceedingly important point, and it must be remembered that one of the factors of Germany's success in rivalling the commercial position of the United Kingdom is that she has always made a particular point of supplying exactly what buyers wanted.

Mr. D. Milne Watson, the Chairman of the Sulphate of Ammonia Association, suggests that sulphate intended for export should carry 24¾ to 25 per cent. of ammonia, and contain not more than 3 per cent. of moisture and 0·5 per cent. of free acid. There is much to be said in favour of the adoption of such a fixed standard as this.

The obvious remedy for the removal of complaints against the quality of British sulphate, so far as the members of this Society are concerned, lies in the manufacture of plant of higher efficiency, especially a still of high grade, and a saturator accurately proportioned to secure the maintenance of an even temperature by the volume of steam and ammonia coming over from the still. Where the quantity of sulphate made will permit, an efficient centrifugal machine should always be included with the plant. This is the most satisfactory method of taking out any excess of moisture. Where the sulphate production is not sufficient to justify the necessary expenditure for a centrifugal dryer, a large draining table should be provided, of such area as to allow ample time for drainage after the salt has been fished-out of the saturator. The open boarded floor or grid of the draining table should be of such construction as to permit the drainage to flow-back to the saturator without obstruction. The final drying of the salt will be completed in the lead-lined store, which must also have an open boarded floor.

Greater care is also needed on the part of the manufacturers of sulphate to ensure that salt is not fished from the saturator with acid of a greater strength than is necessary. The temperature of the whole plant should be maintained at an even figure, and steam-pressure should be kept up. A careful watch should be kept on the effluent, to see that no ammonia is lost, as this is a point in the manufacture that well repay constant vigilance.

My experience has led me to the conclusion that the conditions which must be fulfilled to produce a good quality of salt vary to some extent with each individual plant, even where the plants are precisely the same in construction and detail, and have been supplied and erected by the same firm. This is no doubt due to the variation in the composition of the liquor met with at each gas-works—no two samples of liquor being exactly the same.

Through the courtesy of Mr. J. W. Lee, the Chief Chemist to the Grassmoor Collieries and the Hasland Coking Company, and this year's President of the Yorkshire Junior Gas Association, I am able to give the necessary tests to assist those who have sulphate of ammonia plants under their charge, to ascertain if their own plant is producing a sulphate in accordance with the necessary guarantees. These tests have been added in the form of an appendix.

In conclusion, I may say there is no important industry of the United Kingdom that has not felt the increasing pressure of German competition during recent years. Competition cannot be eliminated from the industrial world. No business man expects or wishes it to be, for undoubtedly it is an essential element of general progress, and therefore competition must be faced.

The war in which we are now engaged removes for the time being the keenest, the most active, and not always the most scrupulous competitor from the business area of our Society; and it is to be hoped that the gas industry will take full advantage of the present opportunity without feeling the least consideration for our nation's enemy.

It may not be reasonable to suppose that the United Kingdom can secure exclusively for herself the whole of the markets of the world in sulphate of ammonia; but since I have endea-

voured to point out the measure of the trade there is to be done, it depends upon the gas industry how much of it the United Kingdom secures in the immediate future, and how much of it can be attracted to, and retained permanently on, her shores.

Appendix.

Analysis of Sulphate of Ammonia.

Sulphate of ammonia is usually analyzed for its content of ammonia, moisture, and free acid. The amount of matter insoluble in water is sometimes estimated. The usual method adopted for estimating ammonia is to carefully and quickly weigh out 1 gramme of the salt and dissolve in water in a flask of about 500 c.c. capacity fitted with a two-hole rubber stopper, through one of which passes a stoppered separating funnel, about 50 c.c. capacity. Through the other hole passes a safety bulb tube, which is connected to the inlet tube of another flask of about 1000 c.c. capacity. This flask is also fitted with a two-hole rubber stopper, and in the other is fitted a calcium chloride tube, filled with glass beads to act as a splash-funnel. Into the second flask place 200 c.c. of water; and then—through the calcium chloride tube—20 c.c. of a normal solution of sulphuric acid are run in.

The flask containing the gramme of sulphate of ammonia is placed on a tripod stand, and through the stoppered funnel 50 c.c. of a strong solution of sodium hydrate is run in. The contents of the flask are then boiled; and the sulphate is decomposed and ammonia evolved.

$$(NH_4)_2SO_4 + 2NaHO = Na_2SO_4 + 2H_2O + 2NH_3.$$

The ammonia is absorbed in the acid of the second flask

$$2NH_3 + H_2SO_4 = (NH_4)_2SO_4.$$

When the distillation is complete the flasks are disconnected, and the inlet tube and calcium chloride tube of the second flask well washed with distilled water into the flask and the contents cooled. After cooling the amount of normal acid neutralized by the ammonia in the 1 gramme of sulphate taken is determined by titration with a normal alkali solution, using methyl orange as indicator.

e.g. 20·0 c.c. N. Sulphuric acid taken.
5·4 „ N. Alkali required.

14·6 „ N. Sulphuric acid neutralized.

14·6 × ·017 × 100 = 24·82 per cent. ammonia.

A method of analysis introduced and adopted by Mr. J. W. Lee, of Chesterfield, requiring the minimum number of weighings, least attention, and fitting of apparatus, is as follows:—

Standard solutions used: $\frac{N}{2}$ Na_2CO_3; $\frac{N}{2}$ H_2SO_4; $\frac{N}{5}$ NH_4OH.

(*a*) 100 grains are dried on a watch-glass for an hour in a water-oven, and the loss due to expelled moisture is calculated.

(*b*) 10 grammes are dissolved in 500 c.c. of water; 25 c.c. are used for rinsing out the pipette; and three 25 c.c. are then separately boiled with a known volume of semi-normal sodium carbonate solution. This forms ammonium carbonate, which is decomposed and driven off on evaporating nearly to dryness. $(NH_4)_2SO_4 + Na_2CO_3 + Na_2SO_4 + H_2O + CO_2 + 2NH_3$. This residue is dissolved again in water, and titrated with semi-normal sulphuric acid, using methyl orange as indicator, to ascertain by difference the amount of sodium carbonate equivalent to the ammonium sulphate originally present.

(*c*) The 400 c.c. left of the solution is now titrated, using methyl orange as indicator, with fifth-normal ammonium hydrate to find the amount of free acid present.

(*d*) To estimate the insoluble matter, 100 grammes are taken, dissolved in hot water, filtered through a weighed Gooch crucible plugged with asbestos, washed, dried in the water-oven, and weighed. The gain in weight equals the insoluble matter.

(*e*) Half and fifth normal solutions are used, and calculated to volumes of normal solutions.

Details of an Analysis of Sulphate of Ammonia.

For moisture—100 grains dried in water-oven.
Wat.h glass + 100 grains sulphate.

	A.		B.
Before drying	338·94	..	348·62
After „	335·94	..	345·60
	3·00	..	3·02

Moisture, 3·01 per cent.

For ammonia—10 grammes dissolved in 500 c.c. of water.

Taken. Cub. Cent.	Normal Sodium Carbonate. Cub. Cent.	Normal Sulphuric Acid. Cub. Cent.	
(*a*) 25 ..	10 ..	2·64	7·36 c.c.
(*b*) 25 ..	10 ..	2·64	
(*c*) 25 ..	10 ..	2·64	

From these 7·36 c.c. must be deducted the volume of the sodium carbonate solution neutralized by the free acid in the solution. The next test shows that 400 c.c. of the solution contain free acid able to neutralize 0·64 c.c. of normal alkali. Therefore 25 c.c. contain free acid equivalent to 0·04 c.c. of alkali.

Deducting 0·04 from 7·36 = 7·32 c.c.
1 c.c. normal alkali = 0·017 gramme of ammonia.
7·32 c.c. = 0·017 × 7·32 grammes.

This is for 25 c.c. and the whole 500 c.c. = 0·017 × 7·32 × 20.
This is in 10 grammes of salt; so the ammonia in 100 grammes
= 0·017 × 7·32 × 20 × 10, or 7·32 × 3·4
= 24·9 per cent. of ammonia.
24·9 per cent. of ammonia × 3·8754 = 96·50 per cent. of sulphate.

For free acid—The remaining 400 c.c. took 0·65 c.c. normal ammonium hydrate to neutralize it; so 500 c.c. required 0·8 c.c. This is equivalent to 0·8 × 0·049 gramme of sulphuric acid. In 100 grammes it will be 0·8 × 0·049 × 10 = 0·39 per cent.

Summary.

	Per Cent.
Sulphate	96·50
Moisture	3·01
Free acid	0·39
Insoluble	0·05

DISCUSSION.

The President *pro tem.* (Mr. Balfour Browne, K.C.) remarked that it was an odd thing that it required a war to teach a country like Great Britain that it was its duty, if it possibly could, to take trade from its rivals. There was one passage in the paper about which he was not quite sure. The author said: "It is not my intention—much less my desire—to introduce into the present paper any kind of political argument in favour either of Free Trade or Tariff Reform." He (Mr. Balfour Browne) was not quite sure about this. He well remembered that, in this Society, he once had a vigorous discussion with their friend Mr. Dugald Clerk upon this very subject. However, in this connection there was one thing about which the author was certain. At the end of the paragraph in which the words that he had already quoted appeared, Mr. Milbourne said: "I have, however, no hesitation in stating that, with equal conditions, we are fully prepared to enter into competition with Germany or any other country in the world." It was the duty of the Government to see that the manufacturers had equal conditions. With regard to sulphate of ammonia, he was exceedingly interested, because, as the members would remember, there was an attack made upon gas undertakings by certain chemical manufacturers, and a clause was introduced into certain Acts of Parliament making it impossible for one gas undertaking to sell its secondary products to another. But Parliament later on appointed a Joint Committee to report upon the subject; and this put the matter upon, at any rate, a right footing.

Mr. John Bond (the President of the Institution) said he had been very interested in the valuable paper read by Mr. Milbourne. The author had treated the subject well; but he (Mr. Bond) had hoped that he would have said something about the synthetic process of making sulphate of ammonia which had been going on in Germany. He believed that in Germany they spent a very large sum of money in propaganda work—much more than was done in this country; and he thought that it would be necessary for the producers of this country to spend a greater sum of money in the different markets of the world to show to what use sulphate of ammonia could be put. This also applied to the home market. He should like to know whether the author had had any experience of the sulphuric acid which was now being used for the manufacture of trinitrotoluol. He had been advised that there was a certain amount of this acid on the market; and he should like to know whether it was suited for the manufacture of sulphate of ammonia. If the author could give them some information as to the quality of the sulphate that could be produced from this acid, it would be valuable to the gas industry. There was one other point which he should like to insist upon. One of the secrets of Germany's success in industry was the extensive amount of systematic research work that went on there. He could not urge too strongly the absolute necessity of research work in this country; and he hoped to see a large development of research by our Universities in every branch of industry.

Mr. A. E. Broadberry said he had followed Mr. Milbourne through his paper with a great deal of interest; but at the same time he had been a trifle puzzled as to how this world's trade in sulphate of ammonia was to become British. Sulphate of ammonia was a bye-product of gas manufacture and coke-ovens. There was only a limited quantity of it that could be made in gas-works, because it depended upon the aggregate amount of coal that was being used. Mr. Bond had referred to the synthetic process of manufacture, which was just about commencing in Germany when the war broke out. If Great Britain was to become the world's supplier of sulphate, they would certainly have to go for further production outside gas-works and coke-ovens to some system such as the synthetic process, in order to satisfy the increasing demand for this particular artificial manure throughout the world. He was not at all clear as to how this country would be able to compete against Germany in producing the synthetic article.

Mr. R. G. Shadbolt (invited by the President) said he had not come to speak, but to listen, and to endeavour to pick up a few wrinkles not from gentlemen interested in the sale of sulphate of ammonia, but from those who provided the apparatus for making it. He thought they might have given a few wrinkles as to how to obtain 25 per cent. ammonia in the finished salt. He was in hopes, too, when Mr. Broadberry rose to speak, that those who were listening would have heard something said about another portion of the paper. [Laughter.] But whether this was a case of discretion being the better part of valour, or whether omission to refer to the point was an oversight, one did not know. After all, it

was a question whether their friends of the Society of British Gas Industries were always as consistent as they would have gas undertakings be. It was very nice from their point of view, and very gratifying, that there should be engineers who specified that everything in connection with a contract should be constructed of British material. One had, however, hazy notions of having seen steel made in Continental manufactories used in structures erected by members of the Society, and which structures they would be the first to claim were all-British. With regard to the sale of sulphate of ammonia, he thought Mr. Broadberry touched the *crux* of the question, when he referred to sulphate being a commodity over the production of which they had little or no control. Then, again, was not the query raised by the writer of the paper as to why, for instance, two-thirds of the export of Germany went to two countries—the Netherlands and Belgium—answered in the last chart, which showed that the price per ton of German sulphate of ammonia was lower than it was in this country; and therefore it would be strange indeed if these countries contiguous to Germany did not take advantage of the fact, and place a large portion of their orders with Germany. Another idea was that, if they had allowed Germany to attack them to the extent of £700,000 in a year, had this country, or had it not, at the end of that period this quantity of excess stock of sulphate of ammonia? If it had, then they were blamable to that extent; but if it had not, then they would be biting off the ends of their fingers if they had not the amount of sulphate to supply. He thanked the author for the business-like way in which he had presented the subject.

Mr. JOHN YOUNG said the principal idea that he had in mind had already been referred to—that was, the manufacture of synthetic ammonia compounds. If this manufacture was introduced into this country, it would be for the benefit of the country, and would enable them to fight the foreigner. But the introduction of synthetic ammonia compounds would not be to the benefit of gas producers or coke-oven owners, or to the manufacturers of gas-works plant. As Mr. Broadberry had pointed out, the sulphate of ammonia obtained by gas-works was simply a bye-product; and the price had already been diminished by the mere "phantom" report as to the manufacture of synthetic ammonia. Gas-works were obliged to produce sulphate of ammonia as a bye-product; and the limit of the manufacture of synthetic ammonia would be reached when the price of the gas-works product had been reduced to such an extent that it left no profit to the synthetic ammonia producers. At present, as the writer of the paper had shown, this country could sell what professedly was an inferior quality article at a higher price than anyone else. What more did they want?

Mr. SAMUEL CUTLER, JUN., congratulated the author upon the very patriotic references he had made in the paper, and which were extremely well-timed, and should do an immense amount of good, if they all only followed out what it was suggested they should do. His firm had had a good deal to do with German competition; and without making any reference to their own particular trade, he could assure those present that the competition for steel work from Germany was not confined to the gas industry. At the opening of the war, there were several contracts in London countermanded altogether with Germany, although partly delivered and partly constructed. This brought them to the point, "Why is it that Germany can produce these materials cheaper than we can?" He said, from his experience, that they did not really produce them cheaper. There was a very intricate system of organized subsidized competition in Germany; and he knew, as a matter of fact, in the particular business with which he was connected there was a very substantial and handsome sum given to their German competitors for work which they delivered and erected in this country. He believed, when the war was finished, the Germans would come over, and again seek the trade of this country. He should be very sorry to be the first German commercial traveller to solicit orders from British buyers. ["Hear, hear."] He thought British manufacturers would have to reorganize their methods a bit in doing more scientific work. In the words of Mr. Bond, there should be more money spent in investigation into scientific manufacturing industries.

Mr. F. TEMPLER DEPREE said he had come across some of the methods of subsidizing at which Mr. Cutler had hinted. If he understood the method in Germany correctly—not only in connection with the gas industry, but in the iron and steel trade—it appeared that the Government itself was in the habit of endeavouring to support the manufacturers, so that labour might be kept in the country. If (say) a £40,000 or £50,000 contract was under consideration, the first question put to the firms tendering was, "What amount of this is represented by labour, and what amount is represented by material?" In a case he heard of a little time ago—it was a contract of some £30,000 to £40,000—the material only represented from 25 to 27 per cent. of the whole; the remainder of the outlay would be for labour. The German Government then said to the manufacturer, "What amount will satisfy you upon the transaction? Ten per cent.? Yes. Then you shall have 10 per cent.; we will subsidize you to that extent." This meant some £3000 or £4000 upon such a contract as the one he had referred to; and the country got the amount for their own country that was represented by the expenditure upon labour. If contracts were going to support labour, then the Government supported the manufacturers to get the business.

Mr. PERCY F. HOLMES proposed a vote of thanks to Mr. Milbourne, to whom he said he was personally extremely obliged. He only regretted that the paper was not sent out a week before the meeting, so that the members might have had a better chance to discuss the figures and facts. They all shared the feeling that Mr. Milbourne had with regard to the German people; and anything they could do by which they could get trade back, they were most anxious to do.

Mr. J. W. GLOVER, in seconding, said there was only one point to which he should like to refer. That was with reference to Chart A. He was unable to see the object of giving Curve No. 3, showing the total exports of the United Kingdom *plus* the total exports of Germany. It made the thing very difficult to follow. Take 1912. The exports of the United Kingdom were 285,000 tons; adding the exports of the two countries together, made 350,000 tons. Therefore Germany's total exports that year would be about 65,000 tons. It would have been clearer if separate curves had been given. There might, however, be some reason for giving the two together.

The motion was cordially passed.

Mr. MILBOURNE said he was extremely obliged to the members for the vote of thanks. He could only say that, in his wildest dreams, he never anticipated that the paper would have raised such a discussion. With regard to the remarks of Mr. Balfour Browne, he thought the members of the Society would henceforth have to undertake to abstain from every topic of political discussion. As to Mr. Bond's remarks, he was not in a position at the present time to say much about the synthetic process introduced by the Germans. He had no doubt that in due time they would appreciate the process in England, and would be able to take their place among the manufacturers of sulphate on this system. It was usual for England to come in second to commence with, but it was also usual for it to gradually work to the top. He had had no experience with regard to the sulphuric acid to which Mr. Bond referred; but he supposed it would not be a very difficult matter to give this particular sulphuric acid a trial. He should think it would well repay the experiment. Mr. Broadberry treated upon the same subject. The point was made that the price this country obtained for lower quality sulphate was somewhat more than the Germans had been able to obtain for theirs. But the reason this country had realized a higher price over the Germans might have been the fact that there was not available a larger quantity of the higher quality article at the lower price. However that might be, he would point out to gas engineers present that the Chairman of the Sulphate of Ammonia Association was evidently very much concerned about the overseas sulphate of ammonia trade. Naturally, he (Mr. Milbourne) would say that, if the British manufacturer could obtain a better price for sulphate of ammonia containing only 24 per cent. of ammonia, undoubtedly they should do so, so long as they could get a market. But they must bear in mind that Germany intended to capture as much trade as it could from the British nation; and no doubt in time, although they might not have sufficient sulphate at present to compete with this country in all overseas markets, no one knew what might be the position in future—more particularly in view of the new process. The makers of sulphate of ammonia in this country should not be content with the position of getting a better price at present for an inferior article. It followed, of course, if they only put 24 per cent. of ammonia into the sulphate, they could make more than if they put in 25 per cent. The replies he had given, he thought, would answer Mr. Shadbolt and Mr. Young. With reference to the remarks by Mr. Cutler, they as manufacturers had undoubtedly felt very much the competition of the Germans. Mr. Depree had also spoken on the same subject. It was well known in England among the manufacturers in the heavy section that the German mills were subsidized by the Government. He believed he was correct in stating that it was to the extent of something like 15s. per ton on all work sent out to England. They were in this way able to run their mills continuously from one year's end to another; and everyone in the trade knew quite well that, if they could only fill up their works, and have them running from one year's end to another, it was cheaper to do this than to have to submit to fluctuations in trade owing to supply and demand. In Germany, of course, when they were very busy, it was impossible to get German materials at the same price as they could buy at in England. But as soon as Germany found there was not much work going on in their own country, the material was sent over here, and then they could sometimes buy it at some 30s. below the English market prices. He did not wish to decry German material. At the present time, he was correct in stating, German steel was quite as good as English steel. But he did think that English gas undertakings should look at this matter from the patriotic point of view. They should consider that the British contractor did a fair share of work in helping forward the gas industry generally. They helped materially, of course, in the National Gas Exhibition. They were invited to take a very broad view of the exhibition; and they subscribed a large amount of money for it. Therefore, they expected that all British contracts might come their way. At all events, they did not think work should go abroad to a foreign firm of contractors who had not subscribed to the exhibition. He hoped that one result of the war would be that they would have Germany, at all events, removed from among them as competitors. He quite agreed with Mr. Cutler that no doubt, after the war was over, they would find the German travellers visiting them again. But he hoped they would all follow the advice that one of their late Presidents gave them, and that they would be able to kick those travellers down stairs with quite as much grace as though they were handing them contracts.

USES OF COAL GAS FOR INDUSTRIAL PURPOSES.

By H. M. THORNTON, J.P., M.Inst.Mech.E.

THIS was a paper read at the meeting of the Royal Society of Arts last Wednesday evening. It was profusely illustrated by excellent lantern slides—some 59 in all; and these, with the paper, were considerably appreciated by an audience which filled every part of the ancient Lecture Theatre in John Street, Adelphi. Before Mr. Thornton read the paper, the Secretary of the Society (Sir Henry Trueman Wood, M.A.) mentioned that Sir Corbet Woodall, D.Sc., who it had been expected would take the chair, had unfortunately been prevented from doing so. It would be with great regret that those present heard that the cause was illness. However, they were fortunate to have obtained the services as Chairman of Mr. D. Milne Watson, whom many of those present so well knew.

In this historic lecture theatre, many of our scientists and scholars, and protagonists in the economic work and advances of this country—indeed of the whole world—have sent forth new messages and made new advocacy, and have contributed to the history of material progress.

Unlike some of them, I have to-night no new message to give you. But I have my story to tell—a story that has an interest not only for every industry in the work of which there is application of heat, but for every individual who has progress at heart, and whose desire is the improvement of our social conditions by the promotion of a more salutary atmospherical environment, and for every individual who sees in the suppression of waste and the substitution of economy some fresh turns of the wheel of civilization.

The Royal Society of Arts has given a wealth of encouragement to all who have such stories to tell. Its records bear testimony to the work of those who have spent time in urging and fostering the improvement of the atmosphere of our towns and cities. A great deal has from time to time been said as to the existence of the insanitary conditions of that atmosphere; and computations have been frequently made by eminent authorities—guided by analyses of the air of towns (especially manufacturing ones), and by measurements of the soot and ash deposits—as to the degree of pollution that takes place under local circumstances. We accept these computations without much question, because those of us who are of a less scientific turn of mind, but whose work is of that practical nature which is complementary to the work of the scientist, daily see the visible and outward signs—despite Acts of Parliament, and the ordinance against the emission of "black" smoke. The important thing is to find an effective remedy; and in this direction I would express the hope that the Departmental Committee on Smoke Abatement (whose work has been interrupted by the war) will be able, through their report, to indicate practicable means for bringing about a material abatement, if not, as we hope, the complete abolition of the smoke curse, and so advance a much overdue reform in the daily conditions of town life.

CRUDE HEATING METHODS AND THE DESTRUCTION OF VALUABLE NECESSARIES.

There are, to make a general division, two main sources of atmospheric pollution—the industrial chimney and the domestic chimney. With the latter, I have not this evening anything to do. In the lectures delivered before your Society in the spring of 1913, Mr. F. W. Goodenough dealt with the domestic phase of the problem, and showed how heating for all domestic purposes could be obtained through the agency of gas—or, in some cases, coke—economically, without dust, without pollution, and with the maximum of efficiency. It is the industrial chimney with which we are concerned this evening, and the displacement of crude heating by a refinement which not only disestablishes the chimney as a polluter of the atmosphere, but introduces into the factory itself a controllable and uniform system of heating, producing constancy of result, and adding materially to industrial economy by the reduction of labour, the promotion of cleanliness, and the speeding-up and improvement of factory output.

These aspects of the case for industrial heating constitute the main part of my remarks this evening. But let me for a few minutes—without going largely into statistics—explain the great destruction of value for which crude methods of heating in our factories are responsible. Mr. Edward G. Hiller, in a paper on "Power Production in the United Kingdom," read before the Manchester Association of Engineers in January, 1914, supplied data showing approximately the quantity of coal consumed in the United Kingdom for various purposes during 1911; and it may be taken that they generally agree with other calculations that have been made:

Factories	used	66·0	million tons
Householders	,,	34·3	,, ,,
Iron and steel industries	,,	32·1	,, ,,
Mines	,,	20·5	,, ,,
Gas-works	,,	15·4	,, ,,
Railways	,,	12·8	,, ,,
Potteries, &c.	,,	5·7	,, ,,
Coasting steamers	,,	2·4	,, ,,
Total . . .		189·2	million tons

Now if we remove from this table only one item which bears upon the subject I have in hand this evening, we see that factories alone consume 66 million tons of coal a year, or just over one-third of the total.

What does this mean in the way of wastage? Supposing the 66 million tons of coal were carbonized in the retorts of our gas-works, and yielded an average of 12,500 cubic feet of gas per ton, we should have from it a total production of 825,000 million cubic feet of gas, which, on the new parliamentary standard of 540 B.Th.U. per cubic foot, would be equal to 445 billion B.Th.U. It is impossible to properly grasp what such figures mean; but these billions of B.Th.U. are B.Th.U. that are in industrial heating controllable, and there is comparatively little waste in obtaining from them effective duty. With coal, there is a large amount of waste of heat units in effecting its combustion and in driving off those volatile constituents which are useless where high temperatures and pure incandescence are required, and must be obtained. There is also waste of heat units up the chimney shaft, and through stand-by requirements. There is waste of heat units every time a fire is re-charged until once more favourable working conditions of the fire are realized. With gaseous fuel—whether using high or low pressure, or low pressure with air-blast—the heat can be directed exactly as needed into the furnace or on to the crucible where required; and heat losses by radiation and otherwise can be largely prevented by proper construction and insulation.

Pursuing the point as to waste, we have our gas as the primary product. There are the secondary ones. First, there is coke. Carbonize the 66 million tons of coal in gas-retorts, and we should have for sale—deducting a reasonable amount for carbonizing fuel—between 10 and 11 cwt. of coke per ton of coal, which would give a total of (say) 35 million tons of smokeless fuel for the market, with a calorific value of (say) 13,000 to 14,000 B.Th.U. per pound—equal to more than 1900 billion B.Th.U. in the aggregate. Then, according to the system of carbonization, and the composition of the coal, we should produce some 10 to 11 gallons of tar per ton of coal carbonized; and so some 700 million gallons of tar would be realized. In addition to this, given good working—using a retort carbonizing system in which there is not a large destruction of ammonia, and with ordinary care to prevent waste of ammonia—there would be produced 28 lbs. of sulphate of ammonia per ton of coal carbonized, or 825,000 tons of a valuable fertilizer.

These figures demonstrate the amount of waste that is taking place by such a large use of coal in our factories. I do not for one moment assert that the calculated data I have given would be realized from the whole of the classes of coal used in factories; but an equal weight of gas-making coals would give, in valuable products, approximately the returns which I have presented to you. Nor do I say that the whole of the coal could be displaced; but an exceedingly large part of it undoubtedly could be. And other industries of the country would be served by the provision of larger supplies of the materials to which I have referred, that are required to meet (especially since the war began) the ever-expanding demands of our population and of the world.

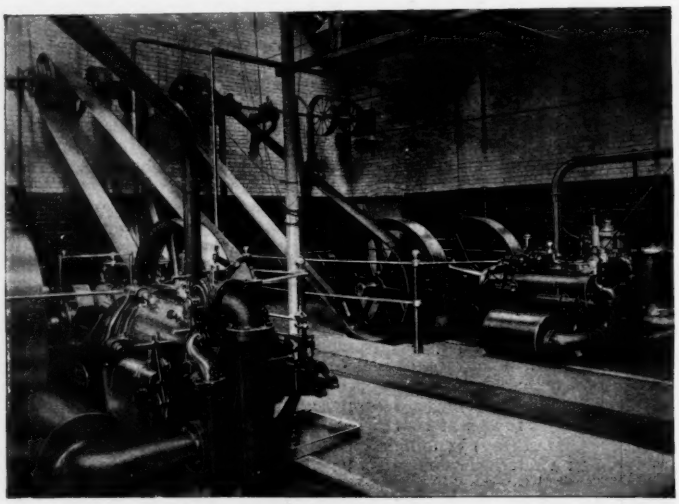
Take tar, for instance. Apart from its value for the production of large quantities of oils of various grades, of beautiful aniline dyes, and of indispensable chemical products, its use has largely grown in recent years for road-surfacing and road-making. With the home extension of the aniline-dye industry to supplant the huge German export of aniline dyes and colours to this country, tar, as the source from which the intermediate products are secured from which the dyes are made, will be required in considerably larger proportion. From tar, too, motor spirit (benzol), among much else, is recovered. According to the quality of the coal used, the system of carbonization employed, and whether the gas is washed for its recovery, from 1 to 3 gallons of benzol can be obtained from different coals per ton carbonized.

The importance of the avoidance of the waste of the valuable necessaries resident in coal is accentuated by the war. Only recently the Army Council notified producers of tar that they require to have placed at their disposal all their production of toluol or substances containing it—such as commercial benzol, light oils, or solvent naphtha—while interfering as little as possible with the existing contracts. When it is remembered that 90 per cent. benzol produced from tar from Durham coal contains about 70 per cent. of benzene and 25 per cent. of toluene (the remainder being light hydrocarbons, &c.), the importance of tar to the Committee on High Explosives and to the nation and its Allies at the present time—and for all time, for our protection and the satisfying of our wants—is self-evident. The toluene, I may add, is used for the making of trinitrotoluol; and as emphasizing the waste that goes on through the crude use of coal, the War Office are now making arrangements with our large gas undertakings for the washing of their gas for the extraction of the toluene from it. From the gas product of a ton of coal (say, 12,000 cubic feet), according to the coal used and the system of carbonization

employed, from 2 lbs. up to probably in cases 5 to 6 lbs. of pure toluene will be obtained. Assuming only 2 lbs., this amount will make 4 lbs. of trinitrotoluol. [See "JOURNAL OF GAS LIGHTING," Feb. 16 and 23, 1915.]

DAWN OF A NEW ERA IN INDUSTRIAL HEATING.

I have thus far trespassed upon your patience in showing that, in addition to air pollution, industry is largely wasting, by its crude methods of heating, parts of the substance of the country which are necessary—more necessary to-day than they have hitherto been, though always valuable since their discovery. I believe I have successfully shown that, for economic reasons, the coal cast under the boilers of the factory, or stoked into the heating furnaces, results in a wastage wholly appalling. The question naturally arises, Is it practically possible to do away with the waste? Admittedly, custom in industry is a difficult thing to eradicate. Manufacturers, however, are beginning to look upon these matters from a more enlightened point of view than of old. In the mechanical handling in our industrial works,



Part of the Engine-Rooms of the Richmond Gas Stove and Meter Company at Warrington, Showing the Gas-Engines Employed.

Science has long since won way; but it has made way at a slower rate in regard to the heating operations, whether it be for melting, annealing, hardening, or otherwise. Experience of the new methods—experience satisfactory in every way—is also having weight. In fact, much has already been done to supplant crude methods of heating by the refinement of gas processes; but this much, my intimate knowledge of possibilities permits me to say, represents only the dawn of a new era in industrial heating.

THE MANUFACTURER'S POINT OF VIEW.

The manufacturer has his point of view in this matter; and, in order to secure his examination of the question from other points of view, we have to adopt the art of "gentle persuasion," though not the "gentle persuasion" practised by the man on strike. So far we have considered the benefit to the community. But here, as in arguing the case for coal smoke abatement, it is necessary to show to the manufacturer that it is not only to the benefit of the community, but to his direct benefit as a manufacturer, to adopt the modern smokeless method of firing. Some of the advantages are:

(1) Economy in space occupied by the appliance; necessity, and expense in some cases, of smoke-stack eliminated; and a practically unlimited choice of position for the furnace, which enables it to be brought into close proximity to the machine workers.
(2) No space required for storage of fuel, and no removal of ashes.
(3) Increase in output per cubic foot of factory, owing to economy of space occupied by gas-furnaces in comparison with hard-fuel furnaces.
(4) Constant and unvarying supply of fuel of uniform calorific value, at a fixed rate.
(5) Labour saving—absence of stoking, storage, and conveyance of fuel.
(6) Rapidity and improved production, due to ability to precisely control correct working temperatures.
(7) In many cases a lower capital expenditure of installations.
(8) Cleanliness, which frequently is of primary importance where furnaces have to be introduced into machine-shops, or in close proximity to machines.

As a concrete example of the foregoing advantages, I would like to quote the experience of a large Glasgow firm of spring-makers. They recently installed seven gas-furnaces in substitution for hard-fuel furnaces, and their testimony is highly interesting. Summarizing it:

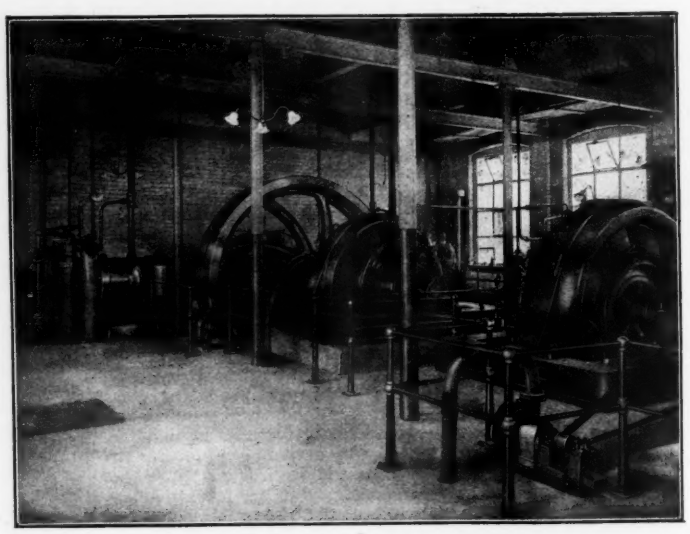
(1) They save two-thirds of their floor space.
(2) They save labour to the extent of dispensing with one stoker.
(3) They secure absolute reliability and uniformity of temperature, which is highly essential in spring-making.
(4) They entirely eliminate smoke and soot in their workshops.
(5) Their fuel bill for coal-fired furnaces was for one year £694; the gas consumption for executing the same work was the next year £425—showing a saving in fuel alone of £269 per annum.

In view of these advantages, it is not surprising to learn that this firm decided to abandon solid fuel entirely; and they now do the whole of their work with gas-furnaces—their consumption of gas being nearly 8 million cubic feet per annum. As another example, the following figures, from a Glasgow firm of chronometer and nautical instrument makers, are highly convincing.

(1) They previously used steam for power, and coke for brass and gun-metal melting furnaces, at a cost of £135 per annum for fuel.
(2) They now use a gas-engine and gas-crucible furnaces; and their gas bill is £105 per annum—showing a clear saving of £30 per annum.
(3) In addition to this, they now secure an average number of six melts per day, as against four with coke-furnaces; and therefore, supplementing a saving of 22 per cent., they have increased their output by 50 per cent.

Having briefly enumerated the national advantages to be obtained by the use of gas for industrial purposes, and also shown how the manufacturer himself may benefit, I will now, by illustration and brief description, show what an important part gas is already playing in the advancement of some of our largest industries, which gives us encouragement to hope that the ideals expressed in the commencement of this lecture may one day be realized.

[The author then had projected on the lantern-screen a large number of particularly well-prepared slides, illustrating some of the principal kinds of plant in which gas is employed for its heating value. Some of the photographs are reproduced to-day with our notice of the paper; others have been given from time to time in the pages of the "JOURNAL;" while for the rest, considerations of space prevent their reproduction.]



The 300 B.H.P. Gas-Engines for Generating Electricity at the Irlam Co-Operative Wholesale Society.

DEPOSING THE COAL-FIRED STEAM-BOILER.

Our attention must be first directed to the primary requirement of most manufacturing establishments—viz., the creation of power. The old coal-fired steam-boiler still exists in numerous factories; but the gas-engine is steadily superseding it wherever its application is possible. The first illustration shows part of the engine-rooms of the Richmond Gas Stove and Meter Company, Limited, at Warrington. The power for these works, which employ over 1000 men, is entirely obtained by gas, amounting approximately to 500 H.P.

In some factories where power is used intermittently, electric motors applied to each individual machine are found more convenient than driving by shafting from a central-power source. In such cases gas-engines are very frequently and advantageously employed for the generating of the current required. An illustration of such a plant is given; while for a large installation of

2700 B.H.P. gas-engines employed for generating electricity at the Crystal Palace reference can be made to the "JOURNAL" for Feb. 21, 1911, p. 511. A Bonecourt gas-boiler for steam-raising, as used in a large works in the North of England, may be mentioned—evaporating, as it does, 1330 lbs. of water per hour.

Proceeding, the author said: I have, with brevity, shown that the first essential for a works requiring power can be provided by gas, whether by means of gas-engines, or by the process of steam-raising, also by means of gas. Having established this point, and before passing on to review the numerous furnace applications for town gas, I should like briefly to mention also the very extended field offered for the use of gas coke for heating large muffle or oven furnaces. As before stated, this great bye-product of carbonization in gas making offers an excellent smokeless fuel, and which Continental manufacturers use much more freely than we do. When used in a modern furnace, we are indeed employing this coke to produce our desired gaseous fuel, and thereby following the dictates of efficiency, of economy, and cleanliness.

REPRESENTATIVE FURNACES.

In the first place, it will, I think, be interesting briefly to describe some of the chief points of the principal types of furnaces.

FROM THE LABORATORY TO THE WORKS.

Gas-heated muffle and crucible furnaces, and so forth, are not new. They have for many years been used in the laboratory for experimental purposes. But these laboratory appliances did not take count of the relation of fuel consumption and of time expenditure to work done, as is necessary in industrial operation. The most that was required of them was the attainment of given temperatures for special work. To translate the old laboratory furnace and crucible equipment to the needs of the factory and large-scale working was not a mere question of rule-of-thumb or proportion. It has meant hard, persistent investigation under the different conditions and requirements of service. Without going into the difficulties at first encountered, and technicalities which would be irrelevant to the general purpose of this paper, it is now a fact that positive success has been attained in the application of town gas as a fuel for large furnaces in ordnance works and a whole range of furnace requirements, down to the smallest crucible furnace for gold melting.

Oven or semi-muffle furnaces have the most extended application of any gas-furnaces. They are required by almost all manufacturing firms in one form or another for the various kinds of annealing, re-heating, case-hardening, and hardening. The different operations require different heats. Light or heavy work will determine whether the furnace should be of medium or maximum strength in structure; while in each case the heat generated must be produced under the most economical conditions commensurate with uniform or even heating. These varying conditions have given rise to three distinct types of furnaces, each having a wide field of usefulness:

(1) Natural draught generater oven furnaces, suitable for annealing, re-heating, hardening, and light case-hardening.
(2) Natural draught reverberatory oven furnaces suitable for the annealing of heavier work and case-hardening.
(3) Low-pressure gas and air oven or chamber furnaces, suitable for annealing, reheating, hardening both high-speed and carbon steel, case-hardening, and forging both heavy and light work.

Each of the two first-named furnaces has its own particular field of usefulness; while the third has such a wide range of temperatures—viz., up to 1400° C.—that it has practically universal application.

NATURAL DRAUGHT GENERATOR OVEN FURNACE.

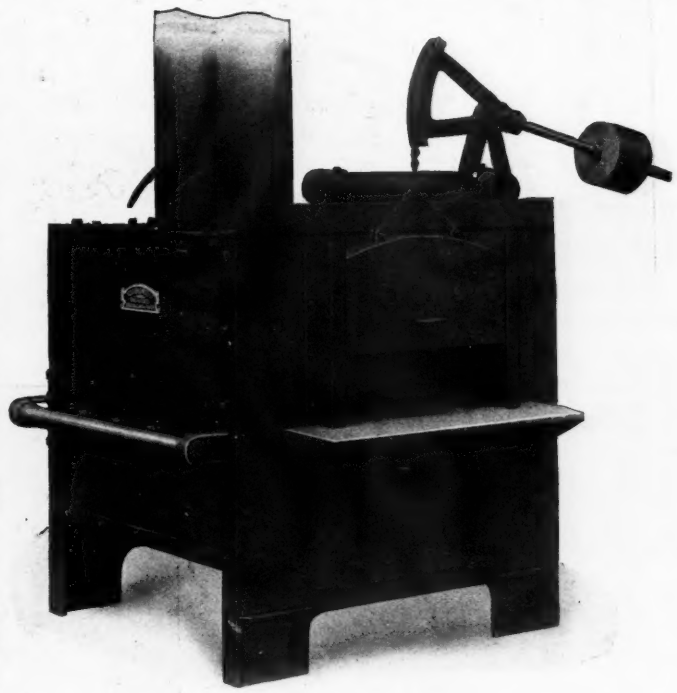
Illustrations in the "JOURNAL" for March 10 last year, p. 655, showed this furnace and a cross section. Special high-power bunsen burners were employed; the burner mouths being sealed from the air at the point of entrance to the combustion chamber. Primary air is admitted to the burner in reduced proportion; while combustion is supported by preheated air entering the combustion chamber by a series of lateral air-nostrils—these being heated by radiation from the floor bricks of the furnace. This furnace is very efficient, and particularly adapted to the lighter class of work—for example, the thermo-treatment of motor gears, which itself represents a very large industry; the hardening of machine and other tools and parts made from carbon steel; the annealing of those parts, &c. The manipulation of the furnace is quite simple. Should a reducing atmosphere be desired for the thermo-treatment of gears, &c., under non-scaling conditions, it is simply a question of reducing the air-inlets; whereas for higher temperatures the air-ports are left open. This furnace has been, and is to-day, a most satisfactory type for the work above described.

NATURAL DRAUGHT REVERBERATORY FURNACE.

This type of furnace, like its precursor, the generator furnace, is on the natural-draught principle, and requires no mechanical plant for air compression. It is heated on the reverberatory idea—that is to say, the gas enters the furnace chamber, and preheated air runs along the furnace bottom through fire-clay nostrils, and meets the burners at the points where combustion takes place. The flame then passes along the underside of the furnace chamber roof, and downwards under the floor of the furnace chamber before entering the flues underneath, and finds its exit up the sides of the furnace wall. The furnace floors are strongly supported—in fact, they may be made to any reasonable thickness to suit the heavier class of work—such as carburizing in boxes, annealing steel in bulk, normalizing steel casting, &c. It will be noticed that this furnace has no combustion chamber other than the working chamber itself. Working results obtained from one of the largest factories in the kingdom prove this design of furnace to be of practical value, and a great success for the heavier class of work where heats up to 950° or 1000° C. are employed, and no air-blast is available.

LOW-PRESSURE GAS AND AIR FURNACE.

The principle involved here is entirely new. Air at approximately 2 inches water-gauge enters the fire-brick lining at the roof of the furnace through a series of fire-clay tubes from the main air supply. The air thus travels down the side, and along the bottom of the furnace, and is preheated—meeting the incoming gas at the point where combustion takes place. The products of combustion then pass along the underside of the furnace roof, and downwards under the floor, as in the case of the reverberatory furnace. An oxidizing or reducing atmosphere is obtained by increasing or diminishing the air pressure. Like the reverberatory furnace, it is of exceptionally strong construction; but it has advantages over the former, inasmuch as it covers a wider range of work—temperatures up to 1400° C. being obtained. This furnace is suitable for all the operations before mentioned,



Low-Pressure Gas and Air Furnace.

besides which it can be usefully employed for baking emery wheels, firing porcelain (with muffle), heat treatment of tungsten ores, and heating-up blanks for drop forgings. Generally speaking, this furnace covers the widest number of working conditions, and has the advantage of being the most economical and efficient for the operations referred to. For annealing steel-bar, it supersedes the generator type of furnace, because it is possible to anneal under the most perfect conditions. In other words, the cooling process in steel annealing, which is spread over something like eighteen hours, may be achieved with this furnace, free from any possibility of cold air finding its way into the furnace chamber, and thus causing scale to form on the work, which, of course, is detrimental.

"GLORY HOLE" FURNACE.

An illustration of a modern gas-furnace used in the glass trade for re-heating and finishing appeared in the "JOURNAL" for March 10 last year, p. 653. The furnace has a circular chamber. The smaller size furnaces are fitted with one cyclone burner—the cyclone flame encircling around the furnace chamber. In the larger sizes a double cyclone burner is used; and the spiral flame heats-up the surface of the brickwork. which is left rugged, so as to absorb the heat and increase radiant efficiency. Glass introduced into these "Glory Holes" is free from flame-contact. The heating is by means of gas at normal pressure, with air at 1½ to 2 lbs. pressure per square inch, or high-pressure gas.

TYPICAL INDUSTRIAL APPLICATIONS.

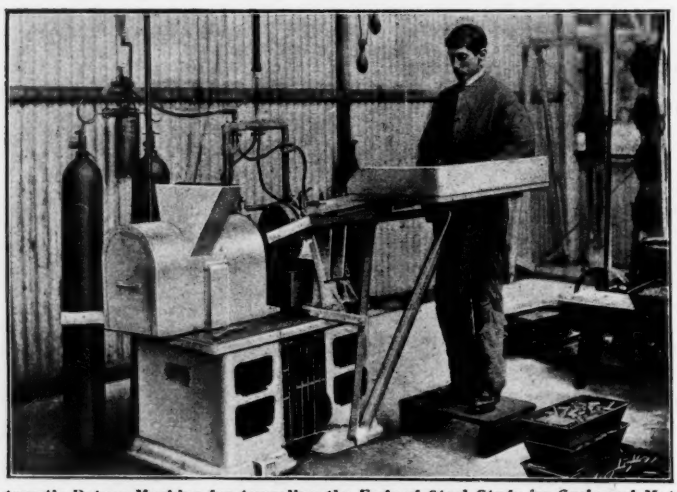
To enter into a detailed description of the numerous industrial

operations for which gas is, can, and will be used, or to give anything but very general particulars, would be an impossible task; but to give a brief review of its uses in some of our leading trades, I think, will be of interest to you.

Annealing.

For the annealing of stampings made from sheet metal, gas is being increasingly used; and where the metal stampings are subjected to one or two heats only, a single-oven furnace serves the purpose. [One was shown in the "Journal" for March 10 last year, p. 653.] Some stampings have to be subjected to the pressing or drawing machine four or five times or more, and require annealing between each operation. This is often the case with special forms of stamped or drawn nickel silver, brass, &c. For this purpose a twin-oven furnace is preferable; the top oven being used for preheating the articles gently before subjecting them to the full annealing temperature in the lower oven—thereby avoiding heat cracking, which may take place when the single-oven type is used. [An illustration in the "Journal" for Oct. 28, 1913, p. 328, clearly shows the working of this apparatus.]

Wire manufacturers in some cases use gas-furnaces for annealing the finer grades of wire. At Cleckheaton (Yorkshire), the wire industry is responsible for a large portion of the 45 million cubic feet of town gas consumed per annum for industrial purposes. The heavier grades of wire are usually annealed by hard fuel; but even at the present time gas-jets are employed at the entrance to the heated chamber to prevent the admission of air, and consequent scaling of the wire. [A twin-annealing furnace with gas-burners was described and illustrated in the "Journal" for Oct. 28, 1913, p. 328.]



Automatic Rotary Machine for Annealing the Ends of Steel Studs for Cycle and Motor Chains.

Gas-furnaces can also be employed for annealing steel tubes [illustrated in the same number of the "Journal," for annealing steel electric conduit tubes], also for softening the ends of steel studs used in the motor and cycle chain-making industry, as illustrated to-day. Another annealing process is a rotating furnace for the metal backs of buttons for ladies' costumes, &c. In some cases the front of the button is covered with cloth, and in others the fronts are japanned. This latter process is also performed by gas. Steel pens, gun barrels and breeches, motor cylinders prior to repairing by the oxy-acetylene process, and many other articles are annealed by gas.

Manufactured steel, in bars, is sent out by makers in an annealed condition; and for this purpose gas-furnaces are being increasingly used. An illustration in the "Journal" for Oct. 28, 1913, p. 329, showed two steel bar annealing furnaces. These are approximately 16 feet long, from which fact it will be obvious they consume gas on a fairly large scale. Annealing in coal-furnaces necessitates packing the bars in a heavy cast-iron box to prevent any scaling of the steel. The elimination of the box naturally means less absorption of heat. Decreased labour is also an important factor—in short, gas annealing has been proved very economical. In many of the smaller steel works where annealing is intermittent, the saving achieved by the use of gas-furnaces is something like 50 per cent. in the cost of fuel alone—a factor in works' economy which cannot be ignored.

The following are figures obtained from actual working:

Annealing Steel in Regenerative Gas-Oven Furnace.

	Carbon Steel.		High-Speed Steel.
Weight of charge	35 cwt.	..	45 cwt.
Total time of heating	6 hours	..	9 hours
Time of cooling	42 ,,	..	40 ,,
Total time of operation	48 ,,	..	49 ,,
Maximum temperature attained	880° C.	..	875° C.
Gas consumpion per ton of steel	3600 c. ft.	..	5000 c. ft.
Cost of gas per ton of steel annealed with gas at 1/6 per 1000	5/5	..	7/6

Succeeding Operations.

Following the progress of the steel bar to the manufacturer of hand and machine tools, gear-parts, mining and agricultural implements, cutlery, ordnance materials, electrical appliances, and the manifold component parts of machinery, we come to the processes of hardening, case-hardening, and tempering.

Hardening.

This process, as you will be aware, is the one whereby steel is converted into its hardest state by being subjected to heat and quickly quenched-off to a cold temperature, either by means of liquid or by air blast.

Case-Hardening.

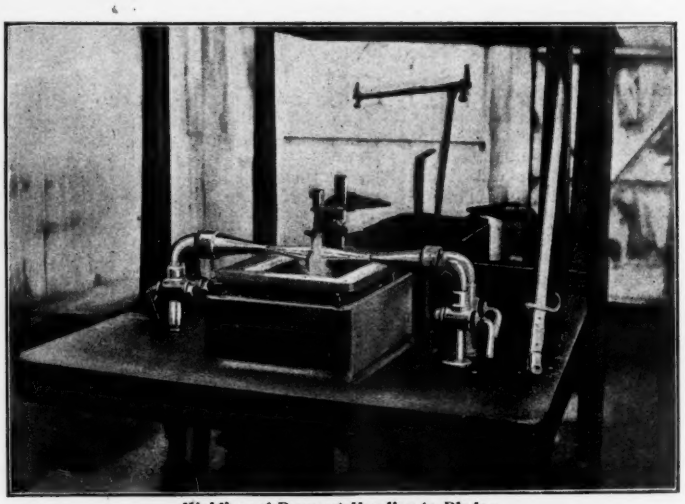
This is the method of converting mild steel (which will not harden direct) into a steel which will harden glass-hard on the surface when quenched-off in water, leaving a soft core in the centre of the bar—making practically an almost unbreakable steel. This steel is, for example, very suitable for gear-wheels, cam-shafts, and bicycle and motor parts. After the carbonizing process is complete, the steel article is subjected to a hardening process, which varies according to the different methods in vogue, and is generally known as the "thermo treatment" of steel. For all these operations gas-oven furnaces are being increasingly used.

A very complete equipment of hardening gas-furnaces was shown in the "Journal" for March 10 last year, p. 656. It portrayed the hardening shop of Messrs. Kayser, Ellison, and Co., of Sheffield.

Tempering.

Here we have the process of heating-up hand and machine tools, gearings, &c., to the temperature which is known to give the temper to the steel. This operation is carried out by two diffferent methods—*i.e.*, tempering by colour or by temperature. Such articles as razors, shear blades, saws, and articles of a kindred nature are frequently tempered by colour on an open or covered heating plate. Tempering by colour of smaller articles is more generally executed in rotary furnaces. Tempering by temperature without colour is done in furnaces containing oil, fat, lead, or salt mixtures.

The various and complex methods of the thermo-treatment of steel to which I have referred in necessarily (owing to time) a somewhat cursory manner, and which differ according to the qualities of steel and methods adopted, illustrate the wide field of usefulness for town gas in all hardening shops—in fact, wherever manufactured steel is used.



Welding of Bayonet Handles to Blades.

Gas and the Production of Munitions of War.

At this critical time in our national history, those of us engaged in the gas industry are naturally highly gratified at the wide extent to which gas is used in the production of our armament and ammunition, in factories, in shipyards, and in Government works. It would hardly be too sweeping an assertion to state that all the requirements of our Army and Navy are under tribute to gas in some way or another.

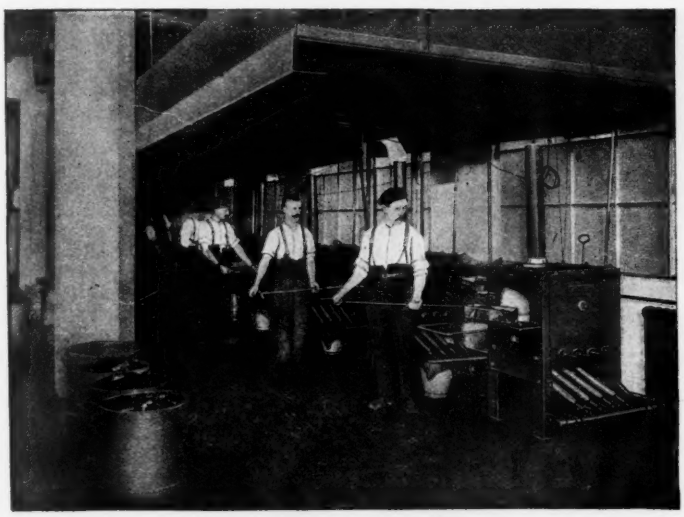
For instance, the heat-treatment of shells—a matter of vital interest to our national existence at the present moment—is largely carried out by the use of gas-furnaces; and the extension of their use in this direction is almost a matter of daily occurrence. Some of these furnaces are comparatively small; but even the largest shells are to-day being treated in this country in gas-furnaces. One furnace recently supplied to an armament firm holds at one charge eleven of the largest naval armour piercing shells—each shell weighing approximately 1 ton. Owing to its size, this furnace

had to be dispatched in sections to the works where it is in operation, and therefore could not be photographed.

Oven furnaces, similar to those I have previously described, are used for annealing component parts of revolvers.

A further instance of the national value of gas during the last eight months in fitting out our new army is given. It shows the heating equipment used in the welding of bayonet handles to their blades.

In the "JOURNAL" for Oct. 28, 1913, p. 333, there was given an illustration of the hardening shop of an important motor and engineering works associated with a famous armament company. Here all the furnaces use gas as fuel; and, since the war started, additional ones have been installed, greatly assisting the output of gear parts, &c., for transport and other vehicles. There are also quite a considerable number of manufacturers who, finding the demand for their usual commodities considerably lessened, if not entirely, though temporarily, wiped-out, have been enterprising enough to adapt themselves to the special demands of the present time, and have had their energy and perspicacity amply rewarded. This conversion of old, and the initiation of new, industries has been going on in this country to a larger extent than is generally known;



Plant for Tempering and Colouring Cartridge Clips.

and in these changes is one more tribute to the genius and energy of the British manufacturer. To the availability of gas, and its elasticity in application, is due the possibility of making these developments, and of making them so promptly and rapidly. Any number of gas-fired furnaces for any kind of heat treatment can be installed; the gas and (if necessary) the air-blast can be connected in almost a few hours; and the new class of work can be inaugurated at once.

To give only one example, a company manufacturing musical instruments found the public demand in war time somewhat lessened. Gas-furnaces were therefore ordered and installed in a few days; and the same shop which produced the former has been transformed into a highly important adjunct to our Army supplies—the tempering and colouring of small steel cartridge clips. Each furnace deals with about 10,000 clips per day.

Another specific instance of how gas has served us during war-time is in our air-craft factories, where gas-furnaces are being used continuously both in the Government and private works which are unceasingly active day and night to enable the country to maintain its supremacy in the air. Unfortunately (perhaps otherwise), I have not been allowed to photograph any of the air-craft factories where gas-furnaces are in use.

Heat-Treatment of Metallic Ores.

This is an industry which has hitherto been largely developed in Germany, and since the outbreak of war the manufacture has been energetically taken up in this country. These ores, which form alloys for special steels, are heat-treated in high-temperature gas-heated oven furnaces, and roasted at lower temperatures in a similar type of oven.

Metal-Melting.

Let us consider for a few moments the subject of metal-melting. The applications of gas for metal-melting are particularly varied. It is used by gold refiners, jewellery manufacturers, goldsmiths, and silversmiths—in fact, wherever precious metal is melted from its solid state for any manufactured process, gas is found to be the most satisfactory fuel.

The melting of brass, aluminium, admiralty, and other alloy metals also presents an important opening for the application of gas-heated crucible furnaces. Some idea of this work in operation would appear from an illustration on p. 330 of the "JOURNAL" for Oct. 28, 1913.

Lead and metal melting is found in many industries. One of the chief and most familiar trades to which gas for lead melting can be applied is the printing trade. In every town—Metropolitan or Provincial—the printing trade is represented in some form or other. The typefounder who supplies the type for the printer requires a lead-melting furnace for type-founding, the stereotyper for stereotyping, and the general melting of metal for composing machines, which is a daily process in large printing offices. One could continue enumerating the applications of gas for melting metals; but enough has been said to show the extensive possibilities for this purpose.

An "internal" heater is sometimes employed for melting soft metal, boiling liquids, &c. This "internal" heater is immersed in the metal or liquid; and therefore the heat utilized is greater than if the burners are placed beneath the tank in the ordinary way. One particular operation consists of putting bones in vats, each of which contains 200 gallons of cold water. After the bones have been steeped for about four hours, the gas is lit, and the hot water cleanses the bones and extracts the marrow. The method previously employed was the injection of steam into the vats; and owing to these being constructed of wood, any ordinary method of gas heating would have been difficult. The invention, however, of this "internal" heater solves the problem; and it is at present performing the work very satisfactorily.

Varnish Making.

Gas-boilers for the making of varnish are being rapidly installed in preference to coal-fired boilers, and have proved to be quicker and cheaper for an equivalent amount of work.

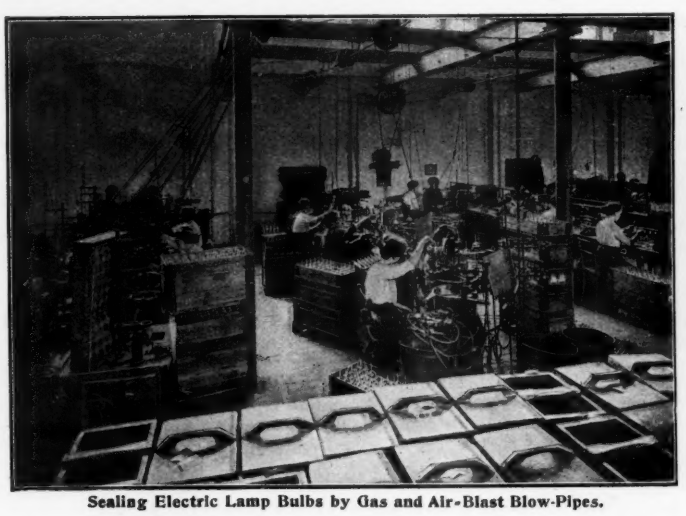
The results in one instance were as follows:

With coal-firing, the time taken was six hours, and a coal consumption of 2½ cwt., at a cost of 1s. 4½d.

With gas-firing, the time taken was two-and-a-half hours, and with a high-power burner consuming 150 cubic feet per hour the total consumption was 375 cubic feet. The approximate expenditure was about 8¾d., free of all labour cost, with the advantage of an increased production and absolute safety from fire, which is a vital factor in the manufacture of varnishes.

Brazing, Blow-Pipe, and Soldering Work.

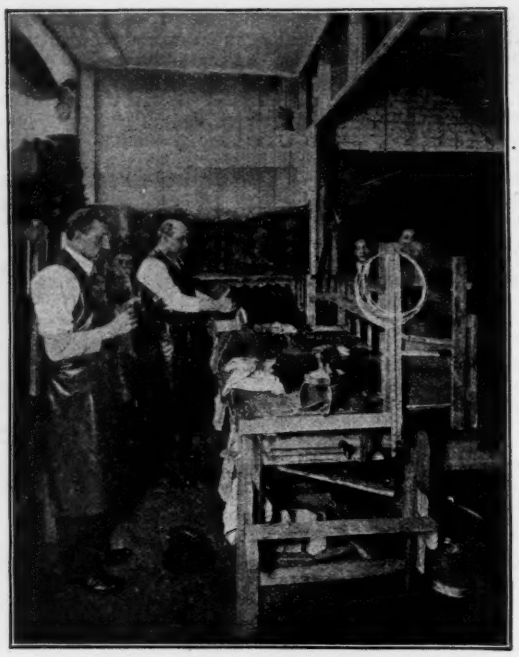
For brazing, blow-pipes with gas and air blast or high-pressure gas are extensively used. Marine engine works and copper tube works have been brazing heavy flanges on copper pipes with hard-fuel brazing furnaces; but quite recently some of them have been persuaded to use gas for this purpose. In this case, the advantage as compared with the hard fuel system is that the metal and flux are kept clean and free from particles of dust, and, therefore, a more reliable joint is made.



Sealing Electric Lamp Bulbs by Gas and Air-Blast Blow-Pipes.

Recently a new brazing method came to my notice. An engineer associated with the Indian railways has introduced a new brazing material in connection with which he advocates the use of town gas. Heavy castings, such as large cog wheels and embossing presses, which have been fractured, have been successfully repaired with his brazing material by the use of gas blow-pipes. An illustration in the "JOURNAL" for Oct. 28, 1913, p. 330, gave a good example of what was done when a cog-wheel had been broken in four places, and after the repair the casting ran perfectly true upon the shaft bearings. Blow-pipe work has many applications other than brazing. For instance, a reproduction is given of a photograph showing electric lamp bulbs being sealed by gas.

Incidentally, it will be observed from this illustration and others that could be given that from the generation of electricity to its use our electrical friends have recourse to the excellent thermal properties of their competitor's commodity. A well-known elec-



Making Peak Caps for His Majesty's Forces at Messrs. Myers and Company's Works, Hackney.

trical firm consumes gas freely for industrial purposes—using gas-fed soldering irons in the manufacture of armatures. Also there is a large factory in the East-end of London dealing with about 14 million tins per annum. At the present time, the firm is engaged on a large army contract for tins to contain rations and biscuits. About fifty gas-heated soldering-iron stoves are used. In addition to this these manufacturers use several gas-heated machines for the spreading of rubber rings to make joints for "decorative work"—*i.e.*, tins with enamelled exteriors to contain liquids, such as paint, food stuffs, &c.

Assaying.

In all metallurgical laboratories, public and private, chemical laboratories, research departments of public companies, and also by analytical chemists, we find useful work for gas. One of the laboratories of the Imperial College of Science and Technology, South Kensington, is fitted with fifteen muffle furnaces, which are employed for the assaying of metals by the mining engineering students. Also the Metallurgical Laboratory of the Birmingham Municipal Technical Schools is fitted with gas-muffle furnaces. [Illustrations of these two places were given in the "Journal" for Oct. 28, 1913, p. 331.] Also at the Heriot-Watt College, Edinburgh, which is one of the best equipped institutions in the country, the assaying laboratory has had installed gas-furnaces for experimental and demonstration work.

Enamelling and Japanning.

In the art of enamelling on metal, china, and pottery, and gilding on glassware, gas is being used most successfully. The famous Ruskin Pottery, for some of its finer productions, is fired in gas-heated furnaces. Also, as a few examples of the very extended use of japanning ovens, I might mention the cycle, bedstead, gas-stove, fire-grate, electrical, tinware, brass hollow-ware trades, as well as many others.

Steam Raising.

We now turn to the raising of steam by gas; and here may be mentioned the gas-steam generators for heating printing-presses. Steam is also required in the bending and shaping of cardboard, wood, umbrella handles, walking sticks, and many other similar articles. Gas is used, and could be universally and economically employed in all these processes.

Glassware Industries.

Quite recently there has been a distinctly forward movement in the adoption of gas for the different heating operations in the manufacture of glassware; and the further growth of this trade owing to the war and cessation of supplies from Germany and Austria will be considerably advanced by the aid of gas. During the operation of glass-blowing, the glass under process of formation requires re-heating to maintain it in a plastic condition. For this purpose gas-furnaces, called by the trade "glory-holes," are now being used. These furnaces are also employed for obtaining a good finished surface on moulded glassware. As soon as the glass-blower has finished his work on the article, it is immediately transferred, while hot, to a low-temperature furnace to allow gradual cooling. In some of the modern glass-works, the furnace for cooling down is of the Lehr type. These furnaces are usually from 40 to 70 feet long; and about one-fourth of the length is heated by town gas to a scarcely visible red temperature. The hot gases from this portion of the furnace travel through the remaining length—thus giving a graduated heat. The articles are placed in the warm end of the furnace and travel down very slowly towards the cool end, carried on rectangular iron trays, which are attached one to another. These trays are drawn along by a hand-winch with a ratchet 2 feet every thirty to sixty minutes, according to the class of work. A furnace of this description may consume about 2,500,000 cubic feet in 300 working days.

In the stained glass trade, gas kilns for firing glass are used. The colours are painted on the glass, the glass is placed on a trolley, and is wheeled into the kilns—the firing taking from thirty to sixty minutes.

Sugar Melting.

Considerably over 350,000 tons of sugar are melted annually in this country for the production of jam and confectionery; and gas is coming to the front in this direction, and results can be obtained with it that should ensure a much more general use for the numerous smaller sweet factories and trades, which may be found in almost any town.

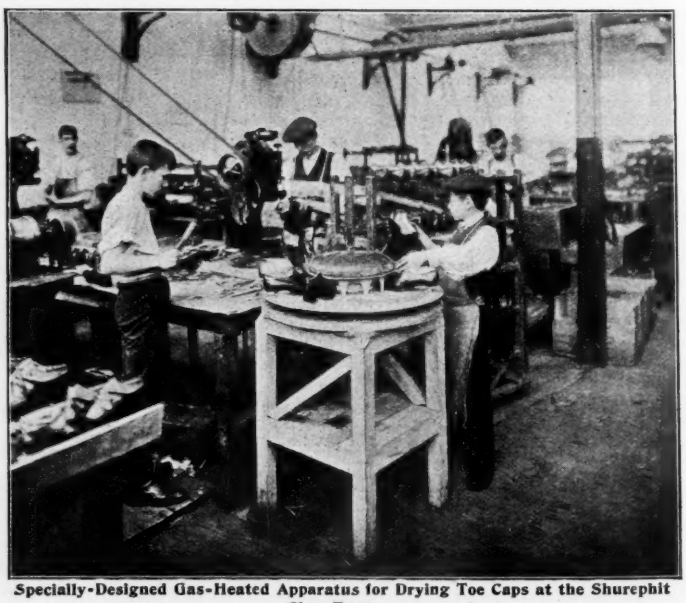
Cotton.

We are well aware how much we rely for our prosperity upon the cotton and woollen industries; Lancashire and Yorkshire between them supplying the whole world with their manufactures in some form or another. Gas is used for the purpose of thread-singeing; the thread being automatically wound off a bobbin, and passed through a naked gas-flame on to another bobbin at the rate of 200 yards per minute—the single threads or strands being burnt off (singed) in the process.

Since the introduction of the present gas method, the improvement in the quality of the material, and in other directions, has been considerable. One machine I know of will use about 300 cubic feet of gas per hour; and it will, therefore, be understood how great is the consumption of gas throughout the County Palatine for this one industry alone.

Cloth Industry.

Gas appliances are used extensively in the cloth industry. [See illustration in the "Journal" for March 10 last year, p. 652.] Here the material is being singed. This process consists in burning-off all the nap and loose threads from the cloth. It is the first stage in the preparation of the cloth for bleaching, dyeing, printing, and finishing; and in this way the surface of the cloth is prepared for the various finishes which it is desired to obtain, and made suitable for being printed upon. The cloth is passed over



Specially-Designed Gas-Heated Apparatus for Drying Toe Caps at the Shurephit Shoe Factory.

gas-burners at a speed varying from 80 to 200 yards per minute, according to the class of goods being treated. It is then run through water to extinguish sparks, and is left in the wet state until it undergoes the subsequent operations of bleaching or scouring. The machine is made specially for use with gas by the largest manufacturer of textile machinery. The consumption varies according to the quality of cloth and the number of gas-burners used; but a single-burner machine, with ordinary width cloth, consumes from 200 to 250 cubic feet per hour.

Tentering is the stretching of the cloth. To enable this work to be carried out more effectively, the cloth is first moistened by being passed through or over a steaming-chamber or damping-box. It is then clipped at each side, stretched, and passed through a machine at an average speed of 40 yards per minute) over gas-

London in the Early Morning.

A Later View the Same Day.

flames, above which is placed a copper sheet, which, when heated by the gas, drives the steam and moisture out of the cloth.

Hat Trade.

In the making of felt and silk hats, gas can be used from start to finish—shellac for stiffening, presses for shaping, burners for singeing, irons for velouring, &c.

Referring again to military requirements at the present time, I give an illustration of a large London factory, which is turning out daily 4500 peak caps for our soldiers. There is a battery of 36 irons heated by gas, while the steam blocks on which the caps are shaped are also heated underneath by means of bunsen gas-burners.

Boot Trade.

The boot trade depends upon gas in several of its processes. One of my illustrations is of specially-designed gas-heated apparatus at the Shurephit Shoe Factory used for drying the cement used for "blocking" the toe-caps of boots. It is a circular table, in the centre of which is a metal chamber heated by gas. In this, holes are cut to allow the toe-caps of the boots to enter, in order that the cement may be artificially dried. It is made to revolve so that there may be as little running about as possible on the part of the boy who attends to this work. Gas is also used for "ironing" (that is to say, finishing-off the boots by ironing the surface of the leather) and "treeing" (that is, making the boots take the exact shape of the last on which they are modelled). The gas is supplied to the centre of this apparatus; and the irons are heated within arm's length of the ironers, so that no time is wasted (as was the case with the more old-fashioned systems) in passing to and from a stove with the irons.

It may also be mentioned that gas is employed for heating the irons for polishing the heels and soles of the boots and shoes. Another large boot factory in the same district uses gas entirely for power, lighting, and manufacturing purposes.

The Universal Servant.

The illustrations shown are but a very few of the many—the Thousand-and-One—photographs that I could have used to demonstrate the multifarious practical applications that have already been made of gas in manufacturing processes. Only the limits of time at my disposal have prevented me from giving many others of equal interest and importance.

May I, however, in concluding my paper, express the hope that the little I have said, and the few illustrations I have shown, have sufficed to make it clear to you what a universal servant to man gas is? Our hats, collars, clothes, buttons, socks and stockings, umbrellas and walking sticks, the making and blacking of boots, the books and newspapers we read, the pens with which we write, the motor-cars in which, or the bicycles on which, we ride—all owe something to gas in their production. Then, again, the stained glass in our churches, the fire extinguishers, the beds in which we sleep—and, what is of vast importance to us as a nation, the armaments for our army and navy—shells and ammunition, guns, rifles, bayonets, swords—in the manufacture of each and all of these gas is largely used. Of my personal knowledge I know that the enormous output of war material we have received from our manufacturers during the last few months could not have been made so rapidly without the aid of industrial gas appliances, many of which in their present economical, effective form are of comparatively recent introduction. It is, I venture to claim, largely due to the service of industrial gas apparatus that our new army is in a position to take the field much earlier than otherwise could have been the case. Gas manufacturing is one of our greatest industries; no industry has ever been developed which has been of more service to the public. It has been shown in many ways that the use of gas-cookers, gas-fires, gas water-heaters for domestic purposes in our large cities and towns has been, in addition to many other advantages, accompanied by a marked increase in the number of hours of sunshine enjoyed by the community per annum, and a decrease in the number of dirt producing and unhealthy fogs.

This is emphasized pictorially by a photograph I have—a view of part of the roofs of London, among which the dome of St. Paul's is prominent in the early morning in the height of summer when domestic fires are not required, and before the factory chimneys have commenced their daily output of smoke, and another showing the same scene on an ordinary working day. It is also stated that the east side of Canterbury Cathedral shows the wastage of the

stone-work, concerning which the Architect to the Dean and Chapter of Canterbury, in a letter to "The Times," said: "The stone is to no small extent rotten behind the crust, and analysis shows that this condition is entirely due to the action of coal smoke."

I am convinced that the further introduction of gas-firing, in substitution for hard fuel direct-firing, will aid materially in the solution of this great and urgent sanitary problem—the abatement of smoke. We may not live to see the supreme reign of this order of things, but each and every one can do his part in advancing the rate of progress in the new era of industrial gas heating—thus utilizing to the best advantage one of the greatest sources of power provided for industry by Nature, and so conserving that great national asset, our stock of unmined coal.

COMPLIMENTARY REMARKS.

The Chairman (Mr. D. Milne Watson) said he was very glad to be present to hear the able paper Mr. Thornton had just read. Before saying anything about the paper, he should like to remark how very sorry they all were that Sir Corbet Woodall was not present to take the chair. Sir Corbet had been looking forward to this evening, and was very anxious to be present. However, he became indisposed the end of last week; and his Doctor would not allow him to come out. He (the Chairman) was glad to be able to say that Sir Corbet was better; and he was sure the wish of all present was that he would soon be completely restored to his usual health and strength. Regarding the paper, it had been a great pleasure to all present to have heard it read. It was always a delightful and instructive thing to hear a man read a paper on a subject which was his own. Mr. Thornton was so eminently an expert on this subject that what he had to say upon it was of the highest interest. His numerous illustrations showed the great diversity of uses to which gas could now be put. There was hardly any manufacturing process to which gas was not at present applied—indeed, the progress that had been made in this special direction during the last few years had been of the most astonishing character. Sir Corbet Woodall told him the other day, when speaking of this paper, that thirty-five years ago, he took the chair for the first time at the Society of Arts. At that period, he believed that not more than 5 per cent. of the gas sold was used for purposes other than lighting. Now no less than 40 per cent. was so used. This was progress indeed. They as gas men believed that they were only at the beginning of a new era in this respect; and if any of them were spared to come to the Society of Arts thirty-five years hence to hear a paper on this subject, the author would have a far different story to tell from that of Mr. Thornton. Wherever they turned, they found gas being applied to manufacture, as Mr. Thornton's paper had so fully and amply demonstrated. Most of those present who were gas men must feel glad of the position gas had taken, and was taking, in meeting the country's new and pressing requirements, and particularly glad because at the moment the gas industry was feeling somewhat under a cloud. The price unfortunately had had to go up; and most of them had been feeling rather gloomy as to the immediate prospect. He was certain, however, that Mr. Thornton's paper had served as a fillip. The advantages and conveniences of gas, too, were so great that the consumers would condone the temporary difficulty with regard to price. The increase in the price of gas after all was not so serious as the advance in the price of other commodities. While gas had gone up from 18 to 20 per cent., coal had gone up more than that. Freights alone had risen 300 per cent. The gas consumer who had to pay an additional 18 to 20 per cent. was, in his opinion, doing very well when the gas company were called upon to pay 300 per cent. more for the carriage of the coal required for the making of the gas. It was not his intention to take up time in dealing in detail with the paper. He thanked Mr. Thornton very much for himself, and also on the part of all present, for his most interesting paper.

Mr. W. E. Price (Hampton Wick) said he thought the paper required to be carried home by those who were less conversant than the author with the uses of gas in industry, and be there well digested. Then they would be able to appreciate better the extent to which gas had been put, and would be put to even greater extent, in the work of the country. The point was an important one that was mentioned in the early part of the paper, as to the amount of coal that was used in the crude old-fashioned way in industrial heating, and as to the great destruction of valuable constituents that resulted. They had seen the effect of this in the last two or three slides, which showed them the result of atmospheric pollution by contrast between an average early morning and later in the day. The contrast showed how immense the advantage would be if there was a compulsory abolition of the use of coal in a crude way. The benefit would be not only a financial one, but an industrial one, and one of hygiene. He was sure that they all appreciated very much the valuable work Mr. Thornton had done in this direction.

Mr. F. W. Goodenough (London) said, as Mr. Price had remarked, the paper was not one that called for criticism or discussion; but it was an excellent statement of the present position of gas in industrial operations. This position he was sure was most gratifying to all connected with the gas industry, and must be a surprise to even the best informed among them. The only criticism he had to offer was that Mr. Thornton, while showing that gas was useful to man in a multitude of ways from the time he was born, had not shown a gas-heated crematorium. [Laughter.] He believed that, at the Dogs' Home at Battersea, they did use a gas-heated crematorium. He thought they were much indebted to the author for the amount of time and labour he had evidently expended in the preparation of such a comprehensive paper; and they would all appreciate it for a long time to come as a valuable record of the position of the gas industry on the industrial side in 1915. What the position would be in 1950 was uncertain, and it was difficult to forecast. It was very interesting to know that the percentage of gas used for purposes other than lighting had gone up from 5 to 40 in thirty-five years. But the figures were more astonishing when it was remembered that the total quantity of gas now used was probably ten times as much as it was thirty-five years ago. Therefore the comparison was as between 5 per cent. on 100 and 40 per cent. on 1000.

Sir H. Trueman Wood said he should like to draw attention to the way the lecture room was lighted. Thanks to the liberality of the Gas Light and Coke Company, the Society of Arts could boast the latest form of gas lighting—a "Nonpareil" inverted ventilating-lamp. It seemed only right that, on an occasion of this kind, they should be using the gas-light, and ignore the rival light—electricity. [Laughter.] While on his legs, he should like to remind the meeting that this old Society had done its share in promoting the progress of the gas industry. The building was one of the first in London to use gas. The Society, too, gave a prize for the first gas-meter, and for the first old water-slide chandelier. It was in that very room that Mr. Thomas Fletcher described what he called flameless combustion, which the chemists at the time laughed at, but which had been again revived. From the beginning up to the present time, when they had heard such an exhaustive paper on the industrial applications of gas, the Society had done its share in extending knowledge of the manufacture and uses of gas.

Mr. Leon Gaster remarked that in certain large clothing factories gas-irons were being very largely used. They had very perfect types of gas-irons and heaters now; and with them quality of work and efficiency were of a superior order than when they used the old wasteful apparatus. He wished Mr. Thornton had shown some photographs of clothing factories where they were doing work with gas appliances. Another application was cooking by the big caterers with whom he was connected as consulting engineer. They were using millions of cubic feet of gas for this purpose; and it was a tremendous advantage, and did away with the storage of fuel. He had asked people whether the work could not be done electrically; but he found it certainly could not be done so cheaply.

Mr. Campbell M. Hunt made reference to the Bonecourt system of heating. He said he understood considerable progress had been made with it during the past few months, and that it had been much simplified. He asked Mr. Thornton whether he could give them any information on the subject.

Mr. Thornton replied that undoubtedly there had been developments in the application of the Bonecourt system to industrial purposes. The Company who had the system in hand was well known; and he was sure that any information in regard to it that was required would be readily supplied by them.

On the proposition of the Chairman, a hearty vote of thanks was passed to Mr. Thornton.

Mr. Thornton, in acknowledgment, said that, had he wanted any thanks, the very enthusiastic reception of the paper by those present had well repaid him for anything he had done. The subject of the use of gas for industrial purposes was one which he had very much at heart. And it had been—he was almost going to say, a hobby with him. It was not quite that, but it had been an interesting study of his for some years. The more he went into it, the more he was satisfied that, by giving all the particulars he could to the public in regard to the many uses to which gas could be applied industrially, he was doing a public service. He had tried to show in his paper that night how great a thing it had been for the nation at such a trying time as the country was now passing through that there had been at command such a readily applicable heating agent. If what he had done on this and previous occasions had helped to speed-up the factories turning out present requirements for the Army and Navy, he should feel quite satisfied.

Prevention of Electrolysis in Concrete Structures.—Mr. Henry A. Gardner, the Assistant-Director of the Institute of Industrial Research at Washington, has communicated to the "Journal of the Franklin Institute" for the current month an article on "Paints to Prevent Electrolysis in Concrete Structures." The following are some conclusions arrived at by the author: "The corrosion of metal embedded in concrete structures, by stray currents of high voltage, is often productive of serious effects. The use of properly-made paints upon such metal constitutes a safeguard that should not be neglected by the engineer. Such paints may be prepared from the following substances: The vehicle should contain boiled or bodied oils or products which dry to a fairly saturated film, oils which dry by semi-polymerization rather than oxidation, oils which dry to a flat rather than a highly gloss surface. The solid portion should contain a percentage of pigments which are coarse, and which therefore tend to form films having a rough surface; pigments which are inert, and which do not act as conductors of electricity; and pigments which are either basic or of the chrome type. The painted metal should be "sanded," if possible.

CLECKHEATON NEW GAS-WORKS.

Visit of the Yorkshire Junior Gas Association.

Members of the Association, in large force, paid a visit, on Saturday last, to the Cleckheaton District Council's new gas-works, at Moorend.

The party assembled in the workshop, where they were heartily welcomed by Mr. Joe Hirst (the Chairman of the Gas Committee), who said he regretted that Mr. A. L. Jennings (the Gas Engineer and Manager) could not be with them, because he was ill. In his stead, Mr. Clifton Lund (the Surveyor) and Mr. Stanley Barstow (the Clerk) would conduct the party over the works.

Mr. HIRST, proceeding to address the members, said most of his hearers would know that Cleckheaton was part of the newly-constituted Spenborough, the result of an amalgamation of three Spen Valley townships; and that day they were going through the first election of the new Spenborough Council. The new constitution might make a very great difference. While their own Cleckheaton population was about 13,000, that of the new area was 32,000 or 33,000. In view of this increasing importance, they were looking forward to much better things and greater improvements in the future. As to the history of the gas undertaking in Cleckheaton, the first gas in the place was supplied 78 years ago, when, in 1837, a small private Company started with a capital of £3500 in £10 shares. This Company eventually moved their works to a new and better position in the town; and in 1870 the undertaking was bought by the late Local Board. In 1837, at the time of the establishment of the undertaking, Cleckheaton had a population of only 3300; and in 1870 there were 13,000 people, when the gas-works were purchased for £23,502. At that period, the production of gas was about 30 million cubic feet per year. At the close of last year, the works had turned out 149 millions. During the time the Local Board held the old works, about £30,000 was spent in new plant. Practically, all this cost had been paid off; and now it had been found necessary to lay down the new installation, which was calculated to produce about 750,000 cubic feet per day, though the new vertical retort-house had been prepared for a capacity of 1,000,000 cubic feet per day. When the works were bought, gas was 4s. 6d. per 1000 cubic feet; whereas now it was 2s. 2d. and 2s. 3d., with a discount allowed. The town was to-day lighted at a cost of £600 per year, which had never been charged to the rates; so that they considered the purchase of the works was a good transaction. The number of consumers last year was 3115; and there were 2100 slot meters, and 140 cookers. They had been fortunate in having as consumers a number of big mills. The new works had a siding adjoining the Lancashire and Yorkshire Railway, from which coal was transferred direct into the works. The plant would be quite equal to any demands they could make upon it, when they completed the work, and got the remainder of the retorts put in.

The PRESIDENT (Mr. John W. Lee) said, under the circumstances, he wished at this juncture, to express the thanks of the members to Mr. Hirst, the Committee, and Mr. Jennings, as they could not do so very well after the visit, when Mr. Hirst would have had to leave them. Mr. Hirst had told them about the place in the language of an engineer, and was evidently well primed and greatly interested in his subject, and in his work as Chairman of the Gas Committee. They all much regretted the absence of Mr. Jennings, who was an old member of the Association, and felt deeply grateful to Mr. Hirst for his presence.

The party then proceeded to inspect the works, under the guidance of Mr. Lund and Mr. Barstow.

The sidings consist of two rows of metals, each providing standage for 22 waggons, with communication at both ends on to the main line. The full coal-trucks run by gravity over the 50-ton ticket-printing weighbridge to the emptying hopper; and the empties are pulled back by a steam capstan for weighing-off. A coke-loading gantry running from the lift in the retort-house to the siding has been erected. To construct the siding, 32,000 cubic yards of material were tipped; the rail-level being 32 feet above yard-level. Part of the material was excavated from the new gasholder tank. The works throughout are of 1,000,000 cubic feet per day capacity, excepting the retorts, which are of 750,000 cubic feet capacity, with power to add.

The members were taken first to the retort-house, where the new vertical retorts were the attraction. These were erected by the Woodall-Duckham Vertical Retort and Oven Construction Company. The installation consists of one bench of twelve retorts and four producers, with provision allowed for a further four retorts when extensions may become necessary. The retorts are 25 feet in length, 3 ft. 10½ in. by 7 in. at the top, tapering to 5 ft. 3 in. by 1 ft. 6½ in. at the bottom. They are built on panelled bricks; the settings being carried on a floor of steel joists supported on built-up steel stanchions. They are panelled-out at the back, so that the heat may readily pass through the walls to the charge of coal in the retort, and a large surface is presented to the heating gases in the flues.

The producer is between two retorts at the front of the setting, and arranged so that it can be operated from the clinkering-stage. On the opposite side of the bench is the waste-gas flue, carried on a concrete floor; and the gases are led away to the 130 feet chimney outside. Each setting is entirely separate from the next. The primary air is taken round the bottom of each retort, and conveyed underneath the producer, where it meets the steam generated in the ash-pans, and a mixture of steam and hot air is carried to the producer. Sufficient steam is provided to keep the clinker soft, and thus the waste heat in the coke is utilized.

On leaving the retort the gas passes through a seal-pot or hydraulic main, after which it goes through a 12-inch rising pipe to the foul main, which runs along the top of the overhead coal-bunkers. The tar overflow is taken from the seal-pot to a 6-inch main running along the side of the bench, and is then carried to the tar-well. On the foul main is a retort-house governor, with inlet, outlet, and bye-pass valves, so as to regulate the pressure. From here the gas is carried away to the condensers and purifiers. Above the settings, on a continuation of the side buck-stays, are the overhead coal and coke storage hoppers, having a 24-hours' storage capacity. The whole of the installation is enclosed in a steel-framed house, with 9-inch brick panelling.

At the side of the retort-house is an 80 feet by 30 feet coal-store; and at one end of the house is a brick building, on the ground floor of which are the engines for the coal and coke handling machinery, while the upper floor is a mess-room for the men, and is fitted with a bathroom. The whole of the foundations are of reinforced concrete.

The gravity bucket coal-conveyor which encircles the retort-bench and elevates the coal to the storage hoppers above the settings, and discharges the coal into the top of the retorts, is capable of handling 50 tons of broken coal per hour. From the overhead hoppers, the coal is fed through a valve into two-hours' auxiliary supply hoppers attached to the top mouthpiece of the retorts. The coke-extractors at the bottom of the retorts have continuous motion, and discharge the coke into hoppers sufficiently large to receive a two hours' make. An even output of gas is thus ensured. Underneath the hopper is a patent water-sealed door, which is opened by hand every two hours, and the coke discharged. For dealing with the coke required by the producers, the contents of the hoppers are discharged by a travelling filler into the same gravity bucket conveyor which elevates the coal; and the coke is thus discharged into the overhead storage hoppers, placed sandwich-fashion between the coal storage hoppers. From here the coke goes through a shoot into the producer; the rate of flow being regulated by a quadrant type of valve. By means of a second door and quadrant valve and portable shoot, the retorts can be filled with coke after scurfing. The coke which is not required for the producers is discharged from the bottom hoppers into skips, and carried to the yard. In case of a breakdown to the conveyor, there is a lift which is capable of raising a load of a ton in skips, at the rate of 60 feet per minute. The whole of the coal and coke handling plant is driven by gas-engines.

On leaving the retort-house, the gas passes to water-tube condensers, and then to a new exhauster (by Messrs. George Waller and Son) of 50,000 cubic feet per hour capacity. There is a stand-by exhauster of 30,000 cubic feet capacity, which has been brought from the old works and renovated. The gas then passes through a Livesey washer and a Holmes rotary washer-scrubber. The purifiers (by Messrs. Clapham Bros.) consist of six boxes 30 ft. by 25 ft. by 5 ft. in a line. They have each two valves—Clapham's "Triumph"—and in addition a four-way valve through which all the gas passes on its way to the purifiers. By rotating this four-way valve through half a circle, the whole of the inlet valves are changed into outlets, and *vice versâ*—consequently reversing the order of the boxes and direction of flow in each box. There are six 30 feet by 25 feet purifiers by Clapham Bros. of Keighley, for removing old sulphur compounds. The station meter (by Messrs. J. & J. Braddock) passes 40,000 cubic feet per hour. Thence the gas goes to the holder, and afterwards either directly through a 20-inch governor or first through a booster and then through the governor.

There is steam-raising plant by Messrs. Umpleby, of Cleckheaton, provided with a Goodrich and Hamlyn forced-draught furnace; the whole of the steam being generated by coke breeze only. The liquid residuals are collected in an underground reservoir, from which they may be piped direct to a neighbouring chemical works or pumped to tank-waggons on the railway. The buildings and plant in the works have been laid out on the outside edges of the site, thus leaving ample space for extensions; while the site is being extensively planted with trees and shrubs, so as to demonstrate that a gas-works can be both useful and not necessarily unbeautiful.

The whole of the works, with the exception of the retort-house, were designed by Mr. Jennings, with Messrs. Thomas Newbigging and Son, of Manchester, as expert advisers.

After the view of the works, the party were provided with refreshment by the hospitality of Mr. Joe Hirst.

The PRESIDENT moved a cordial vote of thanks to all who had contributed to the interest and enjoyment of the visit. Mentioning that he himself had been very busy during 20 hours of the past 24, he said he felt very sympathetic with all those among them who were going to take up the work of the extraction of toluol for the Government, as his own concern was doing, because it would mean some long hours of working.

Mr. CHAS. ROPER seconded the motion. He said an opportunity of looking round a brand new gas-works did not come to them every day.

The resolution was carried unanimously, and Mr. LUND briefly responded.

We have received from Messrs. Whittaker and Co., a copy of "Modern Illuminants and Illuminating Engineering," by Leon Gaster and J. S. Dow. The published price of the work is 12s. 6d. net. A review of its contents will appear in a subsequent issue.

REINFORCED CONCRETE IN A GAS-WORKS.

By Thomas Carmichael.

[A Paper read before Scottish Junior Gas Association, Western District, March 20.]

At the request of your Vice-President, I wish to submit a few notes, gathered together some time ago, on reinforced concrete work as carried out in a gas-works. My only excuse for taking up this subject is that I feel that, if we are to fill our posts efficiently, we should have a good grasp of the several branches of science, and not only be capable of understanding the carbonization of coal and distribution of gas, but at the same time understand, and be familiar with, the plant that we use—be it in wood, brick, steel, or reinforced concrete. We have had many papers on construction, but with very little said on reinforced concrete; and I hope that this paper, though short, will prove of some practical interest, and that points will be raised which will lead to a useful discussion.

The first records of English reinforced concrete date back to about 1831. It has sometimes been proved that reinforced concrete was not born on the Continent, but in Britain. At the same time, it was in America and on the Continent where it was developed and brought to the high state of perfection it has reached to-day. This form of construction did not take in this country for a long time after its development and extensive use abroad; but now within the last ten or fifteen years an interest has been displayed in the work, and its usefulness and economy are recognized almost universally.

There has been much difference of opinion as to the proper name to describe the combination of steel and concrete as a material for building purposes; and it has been called (*a*) armoured concrete, (*b*) ferro-concrete, (*c*) concrete steel, and (*d*) reinforced concrete. The last certainly seems to describe the material to perfection, as to reinforce means to strengthen to a greater degree. Reinforced concrete in engineering practice consists of concrete and steel so placed relatively to each other that the steel takes up the tension strains while the concrete withstands the compressive strains.

Enormous strides have recently been made in the use of reinforced concrete for all sorts of purposes, and nearly all gas-works have in one shape or form found a use for it. I am quite sure that within the last few years reinforced concrete on various systems of construction has found a large number of applications in gas-works, some of which are as follows:—

Coal and coke bunkers,
Coverings of underground tar and liquor tars.
High-level railways and gantries (for coal and coke).
Foundations for vertical retorts.
Coal-store walls.
Retaining walls.
Buildings and columns.
Revivifying floors.
Gasholder tanks, &c.

Although there are, as already stated, many different systems of reinforced concrete, I may explain that all attempt to effect the object mentioned only differ from one another in methods employed and in the forms of reinforcement. All the various types have, I believe, excellent points, and no one has the monopoly of being the best in every instance and form of construction.

The principal advantage of this comparatively new material of construction over steel is that it does not deteriorate rapidly—in fact, when properly made, it increases in strength, which means the elimination of painting and maintenance, so very costly and necessary with steel structures on a gas-works. Also in cost it compares favourably with steel structures. I would refer you to the "Journal of Gas Lighting" for the 2nd inst. [p. 511] where Mr. Gibson, of Liverpool, says: "The gantry may be cheaply constructed in reinforced concrete, which material is particularly suitable for the purpose, as the surrounding coke has no deteriorating effect, and no painting is necessary." And further [p. 513], under annual working costs, "the comparatively low figure under this head is due to the fact that no painting of the structure is needed, as the craneway is constructed in reinforced concrete."

To show that reinforced concrete acts in a similar manner to steel work, I will instance the case of an overhead bunker which had one of its main columns broken through a railway truck coming off the line.

The bunker at this time contained a large quantity of coal; yet, owing to the monolithic nature of the structure, the other members took up the duty of the damaged column, and the only repair necessary was the rebuilding of the destroyed member.

Coke and Breeze Bunkers at Dalmarnock Gas-Works.

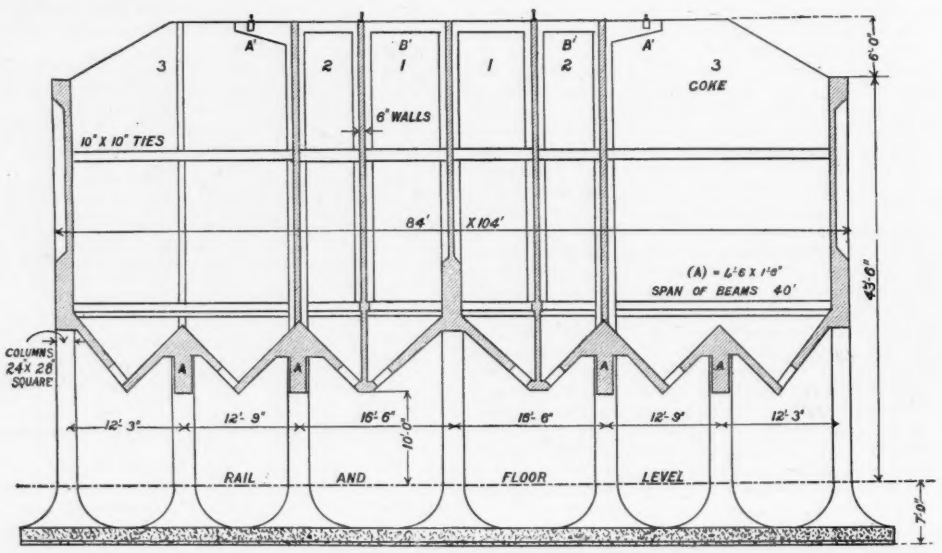
The bunkers are composed of hoppers in reinforced concrete, split up into a number of compartments by vertical walls supported on columns. The total width is 84 feet, length 104 feet, with a height of about 49 feet from the rail-level. The cubic capacity of the bunkers is about 266,500 feet; and the total weight of coke and breeze they will accommodate is approximately 4000 tons. The reinforcement adopted is the "Keedon" system, which consists of round mild steel-bars, fitted with shear members which entirely envelop their various bars and are keyed in position by means of a small key. The entire space underneath the bunkers is free for railway waggons and carts; so that coke can be extracted without trouble from any one particular point.

The ground on which the work was erected consists of firm sand, with water about 10 or 12 feet from the surface. After a trial pit had been sunk and the ground tested, it was decided that a load of approximately one ton per square foot should be worked to. Owing to railway metals running under the bunkers, the tops of the foundations had to be kept 2 ft. 6 in. below the rail level, to permit of the rails and sleepers being laid. The under side of the footings are about 7 feet below the rail-level, and are constructed so as to distribute the load of approximately one ton per square foot over the ground. These footings have a thickness of 6 inches at the outside edge, tapering to the centre directly under the columns to an average thickness of about 24 inches, and reinforced with a network of transverse and longitudinal steel bars and shear members—see photos. Nos. 1 and 2.

The columns were erected on these foundations, and carry the whole of the structure at a height giving 10 feet of clear headroom above the rail-level. The columns in turn are braced by beams which support the walls and hopper bottoms. The main columns, which are square in section, have to support loads of about 400 tons; the reinforcement being composed of round rivet steel bars, one in each corner of the column, and intermediate bars placed between the corner bars, as well as a concentric row in the centre to reinforce the core. These bars are all keyed and bound together by means of hoops spaced 6 inches apart, or spaced according to the work which the columns have to perform.

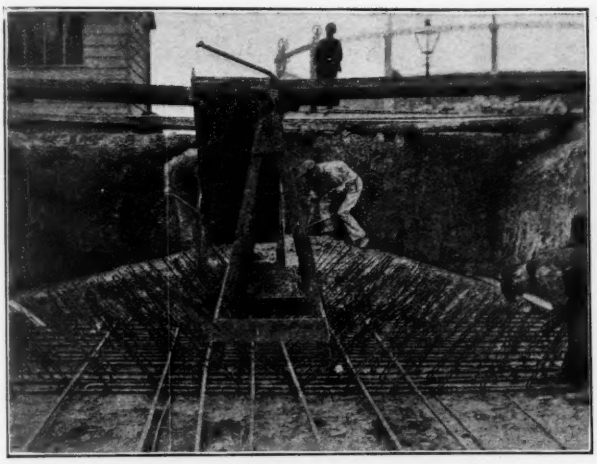
Beams showing on the underside of the hoppers are over a portion of the work 4 ft. 6 in. deep by 1 ft. 6 in. wide; the main span being about 40 feet from centre to centre of the column. In the remaining portion of the work the walls forming the various bunkers are so constructed that their bases, where they meet the apex of the hopper bottoms, do the work of beams.

The hopper bottoms are laid at an angle of about 45 degrees from the horizontal, and are 8 inches thick in concrete at the lowest point, tapering to 10 inches thick where they are supported



CROSS SECTION OF COAL BUNKERS.

by the beams. These bottoms are all reinforced with a network of bars laid in both directions, and are furnished with a number of openings for discharging coke into waggons and carts—see photos. Nos, 3 and 4.



Coke Bunkers—Showing the Footings to the Columns reinforced with Transverse and Longitudinal Steel Bars.

The walls of the bunkers are, in the majority of cases, 6 inches thick; while some portions are 8 inches thick. The walls are broken-up into panels by vertical beams; the whole being reinforced with Johnson's wire lattice. Internally the walls are braced together at the top and bottom by bracings about 10 feet centres. Resting on the top of the vertical walls are stanchions for carrying the ends of the telpher girders which carry the coke-skips for conveying the coke and breeze from the retort-houses to the travelling rotary riddling machine. The riddling machine traverses the whole length of the hoppers, and is supported by the two longitudinal walls.

The concrete consists of 4 parts by measure of Whin stone, 2 parts Whin sand, and 1 part best quality cement. The Whin sand makes an efficient substitute for pit or river sand; but care should be exercised in using it in order that too great a proportion of the very finest sizes should not be obtained, as in the crushing, unless this precaution is taken, fine dust is obtained, which is detrimental, as you all know, to good concrete.

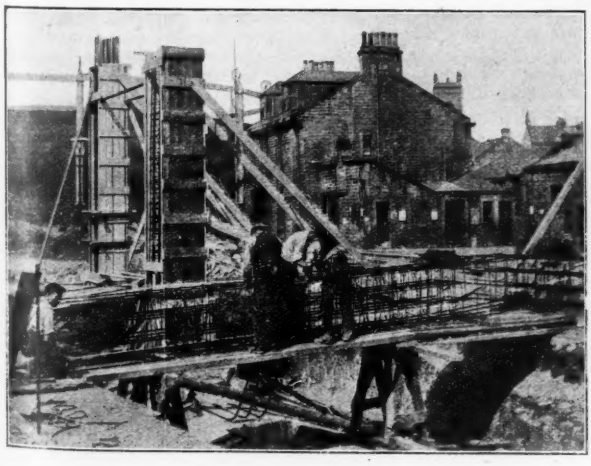
The following results were obtained from a test, mixed in the above proportions, and appear to be highly satisfactory:—

Compression Tests on Concrete Blocks, 6-inch Cube.

¾-inch Whin chips	4 parts measure.
Whin sand	2 parts ,,
Portland cement	1 part ,,

—	Tons.	Tons per Sq. Ft.	Lbs. per Sq. In.
9 days, load at first crack	13	50	776
Crushing load	22·2	85·4	1326
9 days, load first crack	19	74·2	1128
Crushing load	22·6	88 2	1373
36 days, load first crack	28·2	115 5	1734
Crushing load	39·5	156·7	2438
90 days, load first crack	34·3	134	2085
Crushing load	41	160	2488

Notice the increase in strength with age.

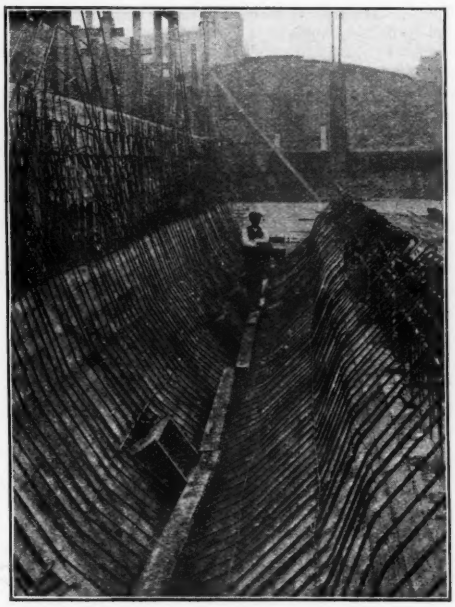


Coke Bunkers—Showing the Columns erected on the Footings and One prepared beforehand ready for lifting into Position.

The working stresses assumed for the concrete in the design of this work were—

Concrete in compression	500 lbs. per square inch.
Concrete in shear	60 ,, ,, ,, ,,
Concrete in tension	Nothing.

The non-conductivity of concrete renders the structure entirely fireproof. This advantage, I would point out, is a very important one, as in the case of coke, where the tendency is to use as little water as possible, there is always a possibility of it catching fire.

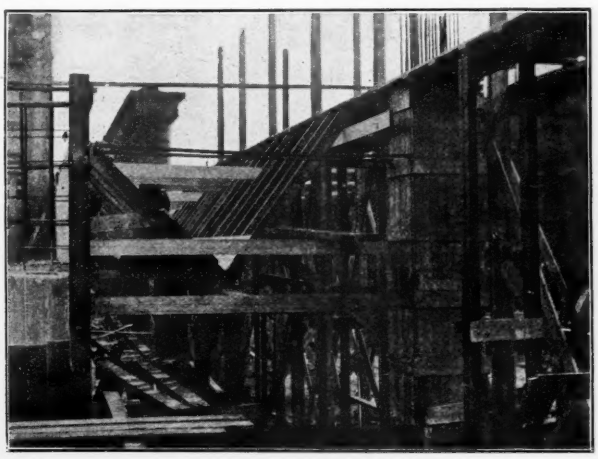


Coke Bunkers—Showing the Reinforcement in the Hopper Bottoms.
[Note the Discharge Openings.]

Steel hoppers and plates become all twisted and buckled if fire takes place in a steel bunker. I have, unfortunately, had an experience of the damage caused by fire in a steel structure of this nature.

High-Level Gantry or Railway in Coal-Store at the Tradeston Gas-Works.

This high-level railway platform has been erected on the Coignet system of reinforced concrete at the Tradeston Gas-Works. The platform has a total length of 362 feet, a width of 28 feet, and a height of 20 feet from the ground level to the top of the



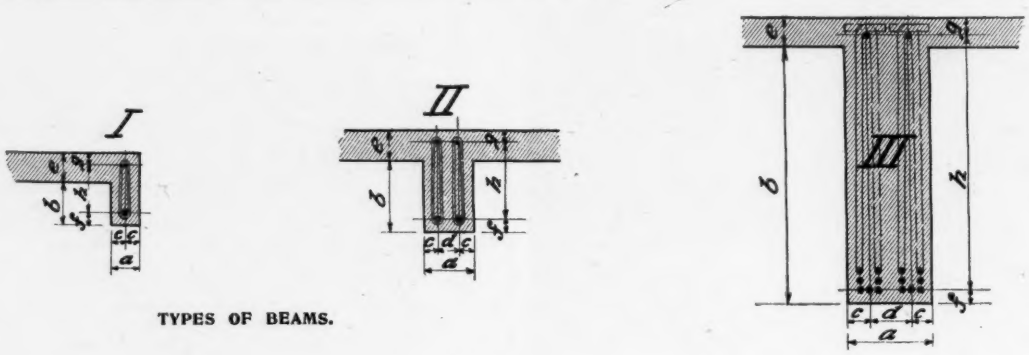
Showing the Centering for the Beams and Hopper Bottoms.

rails, and is for the purpose of enabling coal-trucks to be emptied on to the coal-store. The platform carries two standard gauge rails having openings provided between the rails to facilitate the unloading of the coal.

The railway is composed of a certain number of columns, 36 feet in span; and each of the lines is supported by reinforced concrete way-beams, the ends of which are carried by the columns which, in turn, have suitable footings resting on mass concrete to reduce the load on the ground to approximately 1 ton per square foot. In short, each span contains four columns, 13 inches

Table of Beams.

Type.	Scantling.	Top Bars in Each Beam.	Bottom Bars in Each Beam.	*a.*	*b.*	*c.*	*d.*	*e.*	*f.*	*g.*	*h.*	Remarks.
	Inches.	Inches.	Inches.	In.	In.	In.	In.	In.	In.	In.	In.	
I.—A.	4 by 6	1 bar $\frac{5}{8}$	1 bar $\frac{7}{8}$	4	6	2	—	4	2	$1\frac{1}{2}$	$6\frac{1}{2}$	Across floor slab at openings.
II.—B.	7 by 10	2 ,, $\frac{1}{2}$	2 ,, $\frac{5}{8}$	7	10	2	3	4	$1\frac{1}{2}$	$1\frac{1}{2}$	11	Cross beams between columns.
III.—C.	12 by 36	2 ,, 1	2 groups 7 bars 1	12	36	3	6	4	2	$2\frac{1}{2}$	$35\frac{1}{2}$	Way-beams between columns.



TYPES OF BEAMS.

square, four principal way-beams, 12 inches by 36 inches, supporting a floor slab 4 inches thick.

The above table shows the various types of beams employed, ployed, and their principal dimensions.

The reinforcement of the pillars or columns consists of four vertical bars $\frac{11}{16}$-inch diameter placed one in each corner, bound spirally together by means of $\frac{3}{16}$-inch spiral rod at about 6-inch pitch, and tied to the main bars with a strong annealed wire to prevent them from bulging or the concrete from bursting.

The way-beams consist of two groups of seven 1-inch diameter bars (Type III.), each arranged in such a manner that the ends of six of them are bent upwards at an angle of 45 degrees and looped over a top longitudinal bar. The idea of looping the bars is to provide a mechanical anchorage to each one, and to prevent them from slipping through the concrete. The remaining bar runs straight through, and is turned up about 6 inches immediately above the centre of the column. Vertical stirrups are also provided; and the whole are tied together by means of an annealed wire.

The floor slab is composed of a mesh work of small round bars of various sizes, and at every 5 feet is strengthened between the way-beams by 10-inch by 7-inch beams (Type II.), containing two $\frac{1}{2}$-inch bars at top and two $\frac{5}{8}$-inch bars at bottom, and 6-inch by 4-inch beams containing one $\frac{1}{2}$-inch bar at top and one $\frac{7}{8}$-inch bar at bottom.

The steel frames of the footings, columns, and way-beams were all prepared on the ground in advance, and when required were suspended in the centering and moulds and concreted in. The tying of the bars beforehand prevents them becoming dislodged and out of position when concreting.

Some of the compression test cube specimens taken as the work progressed (to ascertain the resistance to thrusting stress) gave the following results:—

Composition.

Whin chips	4 parts by measure.
Best sand	2 parts ,,
Portland cement	1 part ,,

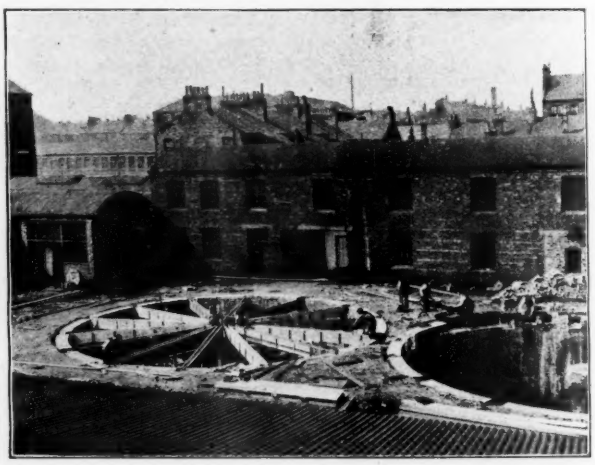
No. of Days.	Load First Crack.			Crushing Load.		
	Total Tons.	Tons per Sq. Ft.	Lbs. per Sq. In.	Total Tons.	Tons per Sq. Ft.	Lbs. per Sq. In.
7	10·5	42·0	653	12·60	50·40	784
14	15·4	61·6	958	16·18	64·72	1007
36	20 8	83·2	1294	23·30	93·20	1450
91	24·5	98·0	1524	25·93	103 72	1613

Note again the increase of strength.

The test load, applied 90 days after completion, was equal to about 50 per cent. in excess of the working load. The permissible deflection was not to exceed 1/600 of the span of the way-beam under test. I am pleased to say the tests were highly satisfactory; the deflection being only 1/3456 of span. After the tests were completed there was no sign of the structure having been unduly strained or loaded, and when the full working load was on, the deflection was never visible to the eye. I may say that the cost of this gantry in reinforced concrete was about 20 per cent. less than the lowest offer for a similar design in steel.

Reinforced Concrete Covers over Tar and Liquor Tanks.

Another example of reinforced concrete work carried out at Glasgow was the covering over of four underground tar and liquor tanks, 40 feet to 45 feet diameter by 20 feet deep. Without going into details, the arrangement consisted simply of a number of slabs of concrete forming a floor or roof, 6 inches thick, and stiffened by radial beams supported on a column in the centre of the tank and resting on the walls at the edges. These slabs, under a test load of 3 cwt. per square foot, deflected about 1/2000 of the span. The work required about 130 cubic yards of concrete, 13 tons of steel, and 988 square yards of centering—costing about £4 18s. per cubic yard. In this connection, see photos. Nos. 5 and 6.



Covering of the Underground Tar and Liquor Tanks—Showing the Tanks and Centering for the Radial Beams.

I should add here that all the various drawings were prepared to the instructions of Mr. Alexander Wilson, the Engineer and General Manager of the Glasgow Gas Department.

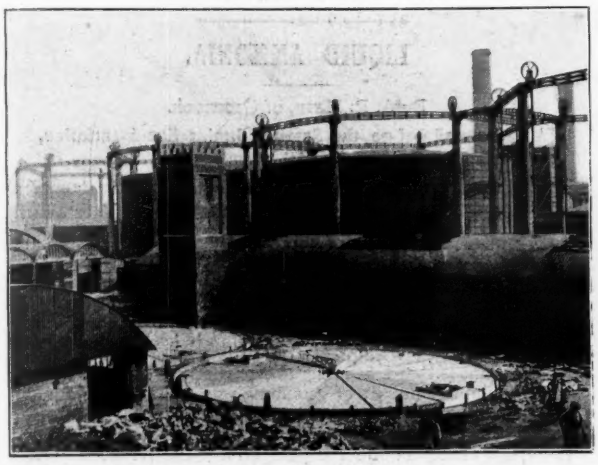
The importance of good mixing of concrete, if satisfactory results are to be obtained, requires no reiteration at this time of day. In the case of the gantry and underground tanks all the concrete was mixed by hand, while all that for the coal-bunkers was mechanically mixed. The mixer consisted of a revolving drum having internal projections which heaped the aggregates towards the centre and forced them together. The mass was discharged while running by tilting, and, apart from giving a superior concrete, soon paid for itself in the saving of labour. All the ingredients were carefully proportioned, and the proper quantity of water added to each batch.

The whole of the concrete was placed in the moulds in the form of layers—it was never dropped from any height—and well worked round the rods so as to ensure a solid mass; good outer surface showing no honeycombed marks, and a perfect contact between the concrete and steel.

Every delivery of cement was tested on arrival by taking a representative sample and testing for fineness, tensile strength, and setting properties. For tensile strength briquettes of neat cement were made up in the mould of the shape shown and having a breaking area of one square inch. This figure should not be less than 400 lbs. at seven days.

It is also a very important point in reinforced concrete construction that, as the concrete is being placed in the moulds, test cubes should be made, not only for ascertaining the resistance of the concrete to crushing, but also for giving some idea at what age the work is strong enough to sustain the test loads, as well as much other useful information. I believe that if test cubes are

properly taken, and carefully tested from the actual job, results approximating very near to the actual results taking place in the structure can be obtained.



Covering of the Underground Tar and Liquor Tanks—Showing the Finished Centering and the Radial Beam, prepared beforehand, ready for lowering into Position.

In concluding, I wish to emphasize that great care is required, and strict supervision necessary, in all reinforced concrete work. The whole safety of the structure depends upon the careful choice and mixing of the materials and the proper disposition of the reinforcements. A weak batch of concrete and some misplaced reinforcements may cost thousands of pounds. It therefore follows that £100 or £200 paid in salary for a reliable clerk of works on any large reinforced concrete job is money well spent.

Economy in this new material is undoubted. It often more than compensates for the extra care required in mixing and centring. Ease and rapidity of erection is also an advantage. The materials are, as a rule, plain bars, which are easily procurable, and require no special treatment as is required in the dressing of stone and in the making of steel girders.

The very rapid progress which has been made in this form of construction during the past few years has led some to believe that reinforced concrete will ultimately displace steelwork construction. Personally, I do not think so. Each form of construction has its own certain applications where it can be used most economically. In any simple beam, the top is always in compression and the bottom in tension; and if we remember that concrete is strong in compression and weak in tension, common sense should at once tell us where the reinforcements should be placed. But if at any time one is in doubt regarding the number and placings of the reinforcements, it is always better to procure expert advice, or err on the safe side by placing plenty in, especially in all tensional places.

I trust I have illustrated the utility and some of the uses of reinforced concrete for gas-works purposes, and made you interested in this combination of steel and concrete, the latest material which the science of construction has evolved.

DISCUSSION.

Mr. J. Napier Myers (Saltcoats), in starting the discussion, said the paper which the President had submitted was very interesting. He was glad that he had put in a word for clearness of diction in dealing with reinforced concrete. Concrete itself was a compound word which they had come to treat as a noun, though it was an adjective; but they would let that pass. They had had an object-lesson at their last meeting of the need for clearness of diction. They were sometimes apt to adopt colloquial terms in speaking, say, of coal. Mr. Carmichael had given examples of the uses to which reinforced concrete could be put in gas-works. At Saltcoats, where he lived, they had recently erected a smoke stack and placed it upon a foundation of reinforced concrete about 2 feet thick. They put it down in layers of 6 inches at a time, reinforcing at every 6 inches by some method of metal reinforcement. At the first 6 inches they laid a mattress of metal, and at the next 6 inches, cross wise, they put two or three old purifier rails. At the succeeding 6 inches, they put another layer of small disused service pipes. The whole made a very stable foundation, on which they erected a chimney, 80 feet high, which they brought into use last Sunday. It was a limited trial; but it had been erected for six months, and showed no sign of settlement. There was another use to which reinforced concrete had been put in a gas-works not very far from there. At Paisley, he believed, Mr. Hislop erected some purifiers where the foundations were entirely of concrete and the sides partly of iron. In the course of his paper, the President had advised them as to the use of the best quality of cement. They were often in doubt as to what this was. He believed that it was only by exercising care which Mr. Carmichael suggested, by means of testing, that they could find out which was the best quality. There was a paragraph near the end of the paper which pleased him very much—the need for great supervision, and highly paid supervision, in the carrying out of concrete work. One in the quietness of the office might write down all he could think of to make a good job, by selecting good cement, by careful mixing of the concrete, specifying it to be turned twice dry and twice wet on a clean floor, with the necessary amount of water sprinkled on it by means of a rose! But when one saw the job handed over to the contractor in dirty weather, amid all sorts of material, and a casual labourer in dirty boots mixing it in a haphazard way, and doing his best to ruin the whole thing, it brought home to one the need for having a strong-minded and highly-paid clerk of works to see the work carried out as an engineer desired that it should be.

Mr. John Frazer (Dalmarnock), in thanking Mr. Carmichael for making a long journey to be with them and read his paper, referred to the question of comparative cost. The President had quoted Mr. Gibson's remarks, as given in the "Journal of Gas Lighting." While Mr. Gibson said concrete was cheaper, he gave them no comparisons. He might say that, since they had started their erections at Dalmarnock, the question had been asked him over and over again as to whether or not steel work or reinforced concrete would be the cheaper. He had not been in a position to give his opinion; and he had not heard a statement for or against up to that night. The President told them that this particular job at the Tradeston Gas-Works cost 20 per cent. less than the lowest cost for a similar design in steel. It was the first time they had had any figures giving them data or anything real to go upon. While he was at one with the President in regard to the tar and liquor tank prices, he would be apt to dispute a comparison between these and the coke-bunkers at Dalmarnock—they, of course, being on the vertical plane and parts at an angle, which made it difficult working, especially in view of the joiner work involved. Again, Mr. Carmichael had remarked about the ease and rapidity of erection. He could not say this was his experience, so far as the coke-bunkers at Dalmarnock were concerned. It appeared to be a case of being retarded all along. They should have been finished months ago, and there was great delay in going on with the reinforcing work. In regard to the cement tests, Mr. Carmichael had told them what they should do. He (Mr. Frazer) was surprised that he had departed from his usual procedure. He generally found out things for himself; but now he had taken his cue from the so-called experts with reference to the condemnation of the very fine sand contained in Whin sand. As he had found out from a series of tests, the difference between washed and unwashed Whin sand was not sufficient to warrant its condemnation. In Dalmarnock they had made a few tests. Three briquettes of Whin sand unwashed—3 parts of sand to 1 part of cement—with 10 per cent. of water, gave them, for seven days, a test of 285 lbs. Three briquettes of washed Whin sand—3 parts sand to 1 part cement—gave them a test for the same period of 240 lbs.—that was with the flour washed out. Ordinary sand that they used every day—2 of sand to 1 of cement—would not stand the machine. This was a peculiar thing. One briquette made with Whin sand in its coarse state, in a mixture of 3 of sand to 1 of cement, gave them 250 lbs. per square inch for 90 days. Three briquettes of Whin sand washings—3 of sand to 1 of cement—for ninety days, with 10 per cent. water, gave 325 lbs. per square inch. Four briquettes of the Whin flour—3 of flour to 1 of cement—for 90 days, with 10 per cent. water, gave 235 lbs. per square inch. With 12 per cent. of water they had 222·2 lbs. The same cement neat gave 409·1 lbs. for 28 days and 740 lbs. for 83 days. It was "against the Government," so to speak, to say that the flour from the Whin sand was not detrimental. But it certainly was not, as the tests he had given proved it to be otherwise. The President had given them tests made in the top of the tanks. The greatest thing of all in connection with the covering of the tar and liquor tanks was the fact that one lost none of the ground space. The great weight placed upon them showed that one could store anything on them. A horse and cart could be driven on top. One obtained the full value for the ground.

Mr. Harrison (Glasgow) remarked that, in regard to concrete constructions generally, there was no branch of engineering requiring greater skill and discretion in the design. There was no form of design where a man might go so far wrong. Therefore, it was very desirable to have an expert to design the concrete structures. He did not mean one of those ferro-concrete firms who set up as experts, but real experts who had carried out structures. Some time ago a representative of a firm came to him and was very anxious to put forward certain designs. He was given certain stresses to work to. He came back and told him he could not find any tables worked out for such stresses! He could not carry them out; yet he set up as an expert. The structures they had in the Glasgow Corporation had all been carried out by firms who had undertaken work before. They had confidence in the strength of the structures erected. The work at Tradeston had been excellently carried out. Great care was taken with regard to the aggregate used in the sand and cement. The aggregate gave them comparatively little trouble; while the sand gave them great trouble. When he told them that much of the sand in the structure cost between 9s. and 10s. a ton, they might judge that no expense was spared. The cause of the delay in the bunkers at Dalmarnock mentioned by Mr. Frazer was entirely owing to the difficulty in getting steel. Personally, he had no doubt the bunkers would have been finished in the contract time of six months had steel been procurable. The author of the paper had shown a briquette on the table. It was unfortunate

that this particular one had been brought there, as it happened to be one from a bad batch that gave low results. However, briquettes were taken from the same batch which gave very good results indeed. The difference between them was caused by the percentage of water used in mixing the briquettes. Then, again, it was essential that an expert should mix, because one could not mix cement as an ordinary bricklayer or mason mixed it. The tests were laboratory tests, and must not be taken as directly significant of the strength finally expected from the cement. As to these tests, he said they would find them laid down in the conditions adopted for reinforced concrete by the British Architects or by the London County Council. To his mind, 600 lbs. per square inch with Glasgow materials was far too large—500 lbs. seemed to be nearer the mark to allow for reasonable safety. He strongly protested against any one who had not had considerable training attempting to design reinforced concrete, because the stresses were decidedly complicated.

Mr. JOHN WILSON (Falkirk) asked if there was no danger of frost having any effect on the coal-bunkers.

Mr. DAVID FULTON (Helensburgh) said he had had the pleasure of going round the Dalmarnock Gas-Works with Mr. Frazer and seeing these bunkers in course of construction. He then remarked that they must cost very much more than a similar structure in steel. The enormous amount of shuttering struck one. It seemed to him that there must be considerable extra labour in the erection of such works as the coke-bunkers at Dalmarnock. It was his opinion that the mechanical mixer did the better work. He thought the finest cement they had in the country was made from Thames mud.

Mr. D. T. MARWICK (Dawsholm) asked how ferro-concrete would do for the bottom chambers in the vertical retort. How would it work for the bogeys for taking out hot coke, instead of the ordinary ones they had at Dawsholm?

Mr. MALCOLM LITTLEJOHN (Glasgow) remarked that, as regards diction, he would like to differ from Mr. Carmichael. He would use the term ferro-concrete. There was a possibility that some other substance than steel would be used for strengthening concrete; and it could not well be called reinforced concrete then. On the question of the deterioration of reinforced concrete, he would like to know what happened in the concrete as years went on. It was conceivable that there might be air-spaces round the concrete, and these would cause rusting and deterioration of the steel. There might, too, be cracks in the concrete, which, going in as far as the steel, would allow air to get at it. One thing about ferro-concrete which seemed to be against it was the question of repairs. If deterioration were noticed, it would be a serious question as to how much repair was needed. It would almost mean that the whole structure would have to be taken down to find how much repair was necessary. In regard to the test-blocks, he should like to have seen them with steel inside. Had Mr. Carmichael any preference for Whin over broken retort brick? Some people much preferred the latter. Personally, he would prefer the Whin, owing to the fact that it was non-porous. He did not agree with Mr. Carmichael that the results from the test cubes could approximate to the actual results. There were not the same surrounding conditions. It was not fair to the structure to say that it ought to have the strength of the cube tested.

Mr. WORKMAN (Glasgow) explained that he had had a good deal of experience in the testing of the cement briquettes and cement and sand briquettes with various percentages of water. He gave the results of several of the latest tests. Three briquettes of portland cement, with 18 per cent. of water for 8 days, gave an average of 613 lbs.; the figures for the three briquettes being 600 lbs., 590 lbs., and 650 lbs. respectively. The average of three briquettes of another Portland cement was 570 lbs. Three briquettes of Portland cement for 28 days gave an average of 441·2 lbs. Briquettes of Portland cement, with 20 per cent. of water, gave an average of 595 lbs. for 90 days.

Mr. J. B. STEWART (Glasgow) did not think the mixing machine was as satisfactory as the hand mixing.

Mr. CARMICHAEL, in replying to the discussion, referred once again to comparative costs, saying that even if ferro-cement were a little more expensive, it would repay itself in maintenance; no painting being necessary. He was pleased to have Mr. Frazer's views on Whin dust, though he was always of opinion that if a lot of this got together in a column it would be a very weak part in the structure and cause a bad accident some time. There was certainly, as Mr. Fulton suggested, a difficulty with shuttering. There was a lot of work in connection with the placing of reinforcements in the bottom of the bunkers. The frost difficulty could well be ignored, as the clerk of works should see that the concrete was rammed round the reinforcements in such a manner that no cracks would be developed. As for Mr. Marwick's question, on making the bottom of the vertical retort of ferro-concrete, it would not do to use it there. It was too heavy. The same applied to its use for bogeys. Mr. Littlejohn disputed the name of reinforced concrete. He was right in a way; but it seemed to him (Mr. Carmichael) that reinforced concrete was the best term, as it gave some idea of what the iron or steel did. From the name ferro-concrete, one got no idea of what the iron was going to do in the beam or column where it was to be used. He could not speak as to the rapidity of deterioration. Concrete, of course, increased in strength with age. As to cost, roughly speaking, steel cost, volume for volume, about 50 times as much as concrete. Again, it was 30 times as strong in compression and 300 times as strong in tension. They obtained by a scientific combination of the two a more economical structure than by separate use of either by itself. He might explain, in reference to Mr. Stewart's remark, that the mixing machine at Dalmarnock was giving good results.

LIQUID AMMONIA.

By A. R. MUIR, of Greenock.

[A Paper read before the Scottish Junior Gas Association, Western District, March 20.]

The title "Liquid Ammonia" is in reality only the technical name for a solution of ammonia in water, and (as you are aware) should be reserved for anhydrous ammonia—that is to say, for ammonia (NH_3) in a liquid state, but technically the title given is quite often used.

The plant in use at Greenock is capable of making 10 tons of liquid ammonia per week, of a specific gravity of ·900, and should contain 28·33 per cent. ammonia. One important feature of the ammonia plant is that a considerable portion of the plant used in the production of sulphate of ammonia was utilized; and should it be desirable to effect a change from the one product to the other, this can be done at very short notice.

The crude ammonia liquor is pumped into the overhead storage tank, which is fitted with liquor overflow and tar run-off pipes. It is then passed through the meter on its way to the superheater, where it is heated to 80° to 90° Fahr. On entering the first still, the liquor mixes with hot milk of lime and commences its travel downwards—as in the preparation of sulphate of ammonia, only in this case a limited supply of steam enters at the bottom of the still, thus regulating the rate of decomposition at this point. The effluent is now pumped through the liming vessel, where it is thoroughly boiled with an excess of steam, passing to the top of the second still, down which it travels, getting yet another boiling with steam to remove the last traces of ammonia before passing away at the bottom through the ball float valve to the discharge pipe.

The hot ammonia gas, along with impurities rising from the top of this still, surrounds the superheating coil, and gives up part of its heat to the incoming crude liquor. The gases now enter the bottom chamber of the reflux tower—which is similar in construction to the ordinary still—and pass up to the reflux condenser, which consists of a water-cooled tube condenser. The temperature of the outgoing gases may be thus controlled, and any condensate separating out of the bottom of the tower is pumped back into the still.

The gases are now led through an atmospheric condenser made from 2-inch steam-piping, then up through the soda washer, containing a strong solution of caustic soda to remove all traces of sulphuretted hydrogen, then through the second and third washers, containing oil and potassium permanganate respectively, for the complete removal of pyridine. The pure ammonia gas is then absorbed in the saturator, which consists of a large closed tank partially filled with water. There are three of these saturators so arranged that the ammonia can be switched on to any one of them at will.

Considerable care should be taken to free the crude liquor as far as possible from tar before pumping into the overhead storage tank, as this product will accumulate in the tank, and, if forgotten, will cause a complete stoppage of the liquor meter; also tar carried forward in suspension in the liquor increases the pyridine content, and therefore the cost of purification. The meter should be provided with a bye-pass, so that in the event of it stopping there will be no trouble with the supply.

The liquor and lime on entering the first still are subjected to a preliminary boiling, just enough steam being used to effect the removal of a considerable portion of the impurities—viz., sulphuretted hydrogen, carbon dioxide, &c., including a small proportion of the ammonia. These gases are passed through a 2-inch pipe to the foul main in the retort-house, and subsequently removed in purification. The 2-inch pipe conveying the gases was at first left exposed to the atmosphere, and very shortly became completely choked with a deposit of ammonium bi-carbonate. On the temporary application of steam, this was easily removed; and by steaming for a few minutes every shift, this trouble has been entirely remedied.

An attempt was made to prepare sulphate of ammonia from the waste gases from the first boiling, which contain (as mentioned) some ammonia, by using the acid saturator in the sulphate-house. The experiment, however, proved unsuccessful, owing primarily to the low percentage of ammonia present; secondly, to the large amount of water vapour being carried over. To prevent this accumulating, it was necessary to raise the temperature of the acid solution by steaming above 212° Fahr. Only a few pounds of salt were obtained in a test covering forty-eight hours.

On the primary still, pressure-gauges should be used at every fourth or fifth section, so that back-pressure, caused by the accumulation of lime or other deposits, may be quickly detected and put right.

The ammonia produced from the commencement by this plant has been sold to a local chemical firm for the production of ammonium carbonate; and at first we were troubled with numerous complaints from them regarding the colour of the salt they

were producing, which they attributed to our ammonia. On investigation, we found that the oil in the washer had allowed a small quantity of pyridine to pass into the saturator. A second washer, containing a solution of potassium permanganate, was added, and since then we have had no further trouble. A low-grade mineral oil, costing 7d. per gallon, is used for eliminating the pyridine. This oil may be recovered by steaming-off the pyridine.

The following quantities of material are required in purification:

Oil	3 gallons per shift
Soda	5 " "
Potassium permanganate	¾ lb. "

A comparison of the costs of production of liquid ammonia and sulphate of ammonia may be of interest.

Quantities of sulphate and liquid ammonia made, 179 tons, each containing 24·5 per cent. ammonia.

Liquid Ammonia.		Sulphate of Ammonia.	
179 tons containing 24·5 per cent. NH_3 . .	£1841	179 tons sulphate containing 24·5 per cent. NH_3 .	£1841
Lime, 123·85 tons . .	£139 6 8	33 tons	£37 2 6
Caustic soda, 10·25 tons	51 5 0		
Oil, 1474 gallons . .	42 19 10		
Wages	380 2 10		392 12 10
Oil, steam, and water .	30 0 0		
Potassium permanganate	14 0 0		
Acid		190 tons	308 15 0
	£657 14 4		£738 10 4

On adding up and comparing the working costs, the results are decidedly in favour of liquid ammonia; also the duties performed by the one man who works the plant are lighter.

It is only convenient to prepare liquid ammonia where and when there is a market for it.

DISCUSSION.

Mr. D. T. Marwick (Glasgow) said in preparing ordinary ammonia it was not necessary to purify it through caustic soda, oil, and permanganate. It would be interesting if Mr. Muir gave them the make per ton of ammonia. The last remark in the paper was the most interesting—that it was only convenient to prepare liquid ammonia where and when there is a market for it.

Mr. John Wilson (Falkirk), referring to costs, said Mr. Muir put 190 tons of acid to make 179 tons of sulphate. Was this not excessive? He would not like to use so much.

Mr. G. T. Purves (Auchengeich), in a note read by the President, said far too little attention was usually given to the bye-products in carbonizing. There were one or two points in regard to results given that were not clear. Why should not something be charged against the sulphate process for oil, steam, and water? What strength of acid had Mr. Muir in mind when he took 190 tons to make 179 tons of sulphate? Mr. Muir had undervalued his 179 tons of sulphate at £1841. He showed a balance in favour of the liquor ammonia. Would the extra capital charges not materially reduce this? On the figures given, there was no great inducement to put down liquor ammonia plant; but Mr. Muir could give further data in support of its adoption.

Mr. David Fulton (Helensburgh) said Mr. Muir referred to a liquor meter being part of the plant. Did this mean that he measured the ammonia liquor passed into the still? The paper gave the amount of oil, soda, and potassium per shift, without giving the make of ammonia per shift.

Mr. Frazer said the subject had been talked of at meetings; but they had never got any further. Those members who were employed in the manufacture of liquor ammonia were very reticent, and seemed to think it a secret business. He was therefore all the more pleased to think that Mr. Muir had come forward. He would like to know what was the strength in degrees Twaddel of the ammonia liquor. The paper stated that on entering the first still the liquor mixed with the hot milk of lime, and then followed a reference to its being further limed. What was the idea of liming it twice? Was he to understand that the first still was under vacuum from the exhauster in the retort-house and that the sulphuretted hydrogen and carbonic acid were passed through the whole of the plant? If so, what method of purification had Mr. Muir in Greenock? Was it oxide, oxide and lime, or a lime catch box? How was the waste lime disposed of? Why in connection with the trouble of blocking in the pipe crossing the yard did they not lay it?

Mr. Walter Grafton (Glasgow) asked the number of tons of coal carbonized. This would give them the quantity of liquor made per ton of coal carbonized.

Mr. Carmichael said the consideration of the paper on liquid ammonia suggested to him that it was the last improvement, unless they tried to recover the nitrogen in the coal.

Mr. Muir, in the course of a general reply, said that the purposes for which the sulphate was sold made the purification referred to by Mr. Marwick necessary. Liquid ammonia did not keep like sulphate, and it was not easy to transport from place to place. He had nothing to say on Mr. Wilson's remark about the quantity of acid used. The figures given were their returns. The strength of the acid was 144° Twaddel. The liquid meter was similar to a water-meter, only there should be no copper or brass fittings about it. It was difficult to estimate the amount of ammonia made per shift. They made about 5½ tons of ammonia in about 3½ days. As to the use of lime twice, the first was to drive off most of the impurities, carbonic acid and sulphuretted hydrogen; the second was to make sure that all the ammonia was off. In purification, they used oxide alone. The spent lime went into the Firth of Clyde. He could not off-hand tell the quantity of coal carbonized.

SCOTTISH JUNIOR GAS ASSOCIATION

(WESTERN DISTRICT).

A Meeting of the Scottish Junior Gas Association (Western District) was held in the Royal Technical College, Glasgow, last Saturday—Mr. Thomas Carmichael, the President, in the chair.

The Social Meeting—Death of Mr. Blair.

The Chairman, at the outset of the proceedings, intimated that it had been decided to go on with the social gathering on Saturday, April 17. The ordinary meeting would be held at three o'clock in the afternoon; and it would be left in the hands of a small Committee to make arrangements for the social gathering, which would be held at six o'clock. He hoped that there would be a very good attendance. It had also been decided that ladies should be present; and he hoped the members would bring the ladies out in large numbers. Before proceeding with the reading of the papers, he wished to refer to the sad loss the Association had sustained through the death of Mr. W. Blair, of Helensburgh, one of their honorary members. Mr. Blair took a lively interest in their proceedings. He was a man greatly respected by all, and his genial presence, his kindly smile, and wise counsel they would all miss. He therefore moved that they record in their minutes the loss they had sustained, and send an extract to the widow and family expressing their sympathy with them in their bereavement.

The Presidential Address and a Paper.

The President then proceeded to deliver his address, which dealt with "Reinforced Concrete in Gas-Works." This was followed by a paper by Mr. A. R. Muir, on "Liquid Ammonia." The communications, together with a report of the discussions to which they gave rise, will be found on pp. 752, 756.

The authors were accorded a hearty vote of thanks for their communications.

Protecting Steel Pipes from Corrosion.

Recent numbers of the "Proceedings of the American Society of Civil Engineers" have contained contributions to a discussion on the subject of the external corrosion of cast-iron pipe. The last portion to hand includes a letter by Mr. W. J. E. Binnie, M.Inst.C.E., whose firm, it may be remembered, was engaged by the West Australian Government, in conjunction with Sir William Ramsay and Mr. Otto Hehner, to report on the remedial measures to be adopted in order to arrest the corrosion taking place in the pumping main for the supply of water to the Coolgardie Goldfields. The external corrosion of the main was most active in saline and in clay soils; but where it was laid through light sandy soil, corrosion was generally slight. The remedial measures undertaken to deal with the external corrosion where the pipe had to be underground consisted in opening the trench, cleaning and scraping the outside of the main, re-coating, and wrapping it with tarred Hessian. The writer was fairly confident that the tarred Hessian, if perfect, would in itself be sufficient protection. His firm are now laying a steel pipe-line from Wales across the estuary of the River Dee to Birkenhead. Where the pipe crosses the estuary it is in salt marshes slightly below high-tide level for several miles, and, owing to the high pressure and other reasons, it was desirable to use steel pipes. They are flanged, and, in accordance with the restrictions placed upon the Birkenhead Corporation, they had to be laid underground. The firm decided to take the following precautions: (1) To wrap the pipes externally with two layers of Hessian treated with a bituminous solution similar in composition to that used for cables; and (2) to lay the pipe in lime concrete except at the flanges, which will be surrounded with puddled clay mixed with slaked lime in the proportion of 6 parts of clay to 1 part of slaked lime, in order to facilitate the replacement of a faulty pipe.

Midland Junior Gas Association.—There will be a meeting of the Association next Saturday afternoon in the City of Birmingham Technical School, when Dr. W. B. Davidson will deliver a lecture on the "Extraction of Toluol on Gas-Works."

Chlorides and Chlorines in English Coke.—At a meeting of the Society of Public Analysts, a paper on the soluble chlorides and the total chlorines in some English cokes was read by Mr. Stanley W. Bridge. The author had recently examined a number of samples of coke derived from English coals and cannels from different districts, with the object of determining the amount of soluble chlorides and total chlorine they contained. The results show that very considerable variations occur, and that they are in general of the same order as in the coal. The proportion of the chlorine remaining in the coke depends, however, also to a large extent on the temperature at which the coal has been carbonized; the coke obtained from the same coal by low-temperature carbonization being much higher, both in soluble chlorides and total chlorine, than that produced at a high temperature.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Examinations in Gas-Fitting.

SIR,—I notice a remark by Mr. W. N. Westlake, at the meeting of the Southern District Association last week, relative to the examinations in gas-fitting.

Might I, as one of the Chief Examiners, point out that, in framing the questions, we followed the instructions of the Council of the Institution itself—viz., that for a year or two the questions to be set should be elementary—and that Mr. Thomas Glover's remarks (following Mr. Westlake's complaint) convey the intentions, not only of the Council, but also of the conference on the question at Liverpool.

If I have anything to do with the setting of the examination papers in the future, it will be a year or two before much stiffer questions are set. We have to remember that these men have to be dealt with gently, as they have not been used to either attending lectures or sitting for examinations.

H. KENDRICK,
Engineer and Manager.

Stretford Gas Company, March 15, 1915.

Use of Tar in Present War Times.

SIR,—As one having had a long experience of the tar trade, I would appeal to the gas industry, through your columns, to exercise the same patriotism in the disposal of their tar as some of the large gas undertakings have already so conspicuously exhibited towards employees going on active service.

If raw—that is, undistilled—tar is in the coming summer wasted on road-making, and for the various private purposes for which it is retailed, as it has been during past years, it will be a serious injury to our country and also to our allies.

There is the most urgent need for the supply of picric acid and "T.N.T." [trinitrotoluol]. For the latter the available supply of toluol in the country is quite insufficient. Every ton of tar produced ought to be distilled, so far at least as to get the toluol and carbolic yielding oils. For road-making, asphalting, and every purpose for which tar is retailed in small quantities at gas-works, a prepared or refined tar, from which these oils have all been extracted, will do quite as well or even better.

It is very easy for gas companies to get this at wholesale price to supply their retail trade, whether an Order in Council is shortly issued or not. The Germans are now getting great supplies from their large bye-product coke-oven installations.

J. F. KEMPSON.

Sheringham, March 17, 1915.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress had been made with Bills when the House rose for the Easter recess last Tuesday :—

Bills reported, with amendments: Ilfracombe Gas; Spennymoor and Tudhoe Gas.

The opposition to the Brighton and Hove Gas Bill has been withdrawn.

The Lapley and Wheaton Aston Parish Council have presented a petition against the Wolverhampton Corporation Water Bill.

The Ormskirk Gas and Electricity, Prescot Gas, South Staffordshire Water, Sutton Water, and Wolverhampton Corporation Water Bills have been referred to a Select Committee, consisting of the Duke of Wellington (Chairman), Lord Latymer, Lord de Mauley, Lord Armstrong, and Lord Lyell; to meet on the second sitting day after the Easter recess.

The Altrincham Gas, Frimley and Farnborough District Water, Northwich Gas, Sunderland Corporation (Wearmouth Bridge), Warwick Gas, and Yorkshire Electric Power Bills have been referred to a Select Committee, consisting of Lord Hylton (Chairman), the Earl of Clarendon, the Earl of Eldon, Viscount Falkland, and Lord Avebury; to meet on the second day after the Easter recess.

HOUSE OF COMMONS.

Up to the time of the House rising for the Easter recess last Tuesday, the only further progress made with Bills had been the reporting, with amendments, of the Ascot District Gas and Electricity Bill and the Doncaster Corporation Bill. The first-named Bill has been considered, and stands for third reading.

DEWSBURY CORPORATION BILL.

This Omnibus Bill was last week before the Local Legislation Committee of the House of Commons, presided over by Mr. MIDDLEBROOK. The part relating to the Corporation gas undertaking was dealt with on Tuesday and Wednesday.

Mr. VESEY KNOX, K.C., and Mr. VILLIERS BAYLEY appeared for the Corporation. There was no opposition.

Mr. VESEY KNOX explained that the Bill proposed to extend the area of supply, to adopt a calorific test in lieu of the illuminating power test, to purchase gas in a crude or partially purified state, and to make certain other general provisions relating to the gas undertaking. The new districts which it was proposed to add to the existing limits of supply were Emly, Flockton, and Whitley Upper.

Mr. *G. W. Fligg*, the Manager of the Corporation gas undertaking, said already Whitley was being lighted by the Corporation without statutory powers, mains were laid in Flockton, and negotiations were going on for supplying Emly. Agreements had already been entered into with Flockton and Whitley to supply gas at 3s. 6d. and 3s. 4d. per 1000 cubic feet respectively, and the proposed price in Emly was 3s. 8d., as against 3s. in Dewsbury, with 2½ per cent. discount for prompt payment.

Mr. VESEY KNOX, on the question being raised by the Committee as to why the difference in price in these outer districts should be a fixed one and not a falling or rising one according to the price in Dewsbury, said the prices arranged were very low for such small areas, and had been accepted by the local authorities.

The COMMITTEE, however, thought that some differential should be arranged for; and the point was adjourned for a proviso to the clause to be drafted.

When this proviso was subsequently submitted, it provided that, as from the expiration of any agreement made before the passing of the Act, the prices charged should not exceed that charged in Dewsbury by 8d. in Emly, 6d. in Flockton, and 4d. in Whitley.

Mr. VESEY KNOX, in answer to the CHAIRMAN, said that the agreement now in force with Whitley had a year to run, that with Flockton thirty years, and that contemplated with Emly (and which, if signed, would be signed before the passing of the Act), thirty years. The latter authority, however, were also negotiating with the Yorkshire Electric Power Company, and might take electricity instead.

The CHAIRMAN said the Committee were not satisfied with the proposal. In the event of a decrease in price in Dewsbury, the outer districts ought not to be burdened with the fixed price.

Mr. VESEY KNOX said the authorities had made the bargain and agreed to the fixed price, with its advantages and disadvantages; and he hoped the Committee would sanction the continuance of the agreements. All three places were a considerable way from the gas-works, and were quite small.

The CHAIRMAN: I think you will agree that the duty of this Committee is to see that the inhabitants of small areas particularly do not have put upon them, or do not put upon themselves, a burden which may in the future be unduly hard upon them.

Mr. VESEY KNOX said that 3s. 6d. was not a high price, and in the smaller areas dealt with in the Doncaster Bill, which was last before the Committee, the price was much higher.

The CHAIRMAN said the Corporation would not want to supply these places unless they thought it would pay them. Conditions being equal, there was no reason why these districts should not be supplied at the same rate as Dewsbury. The Committee recognized, however, that, in view of the long distance over which mains had to be laid, the Corporation were entitled to some recompense in respect of this, and were therefore entitled to charge a higher price. When, however, the price in Dewsbury was lowered, the extra 4d., 6d., or 8d. should still be sufficient to cover the capital charges on the mains; and this would still leave the profit on the supply.

Mr. VESEY KNOX said it was not only a question of mains. Working expenses were higher in regard to maintenance, and there was the extra cost of collection. It would also probably be mainly a prepayment meter district, and the repairs and maintenance on these would be heavier, owing to the longer distance they would have to be brought to be dealt with.

The CHAIRMAN said the feeling of the Committee was that the existing agreements ought not to be binding for more than ten years, and that then the differential proposed in the proviso should come into force. This applied to the two districts affected by the thirty-year agreements. The one-year agreement would not be affected.

The clause was altered to meet this decision.

Mr. VESEY KNOX, referring to the calorific power testing clauses, said these followed those in the Ossett Bill last year; but they differed slightly from the Model Clause. The important change was that the apparatus for testing was specified as "the most suitable for ascertaining and making the test." There was no absolute definition of the apparatus. In the Doncaster clauses and in the Model Clause, the apparatus was that prescribed by the Metropolitan Gas Referees. It was a matter for the Committee whether they agreed with the promoters that it would be better to adopt a form already granted to a neighbouring gas undertaking—viz., Ossett.

Mr. KNIGHT, of the Local Government Board, said the intention of putting the clause in the Model Bill was that the clause should be standardized.

Mr. VESEY KNOX said that in the Doncaster clauses passed by the Committee last week the Model Clause was not followed. The Lord Chairman's Counsel saw some reason to alter the wording slightly.

Mr. KNIGHT: But from the point of view of apparatus surely it is better that they should all be in the same form?

Eventually the Committee decided that the clauses should be amended to follow the wording of the Doncaster clauses.

Mr. *John M'Cann*, the Chairman of the Gas and Water Committee, gave evidence with regard to clause 22, which gives power to purchase gas in a crude or partially crude state. Some of the coal mines in the district dealt with a semi-waste product—viz., very small coal—in the working and smelting of ore, and in doing so generated gas. The Corporation desired to purchase this gas, as it could be used beneficially in certain trades. One firm of colliery proprietors were producing a large quantity of such gas, and were using it commercially.

The clause was allowed.

The remaining clause which provoked some discussion was No. 23, which provided for dealing with deficiencies or profits on the gas undertaking. Hitherto in Dewsbury the rather unusual condition has applied that any deficiency shall be charged on the borough fund or on the general district fund or both, as the Corporation may determine. The same applies to profits. Actually, the Corporation have applied the profits—there have been no losses—to the borough fund; but clause 23 proposes to incorporate the general law of the country, and compels the Corporation to charge any deficiency or transfer any profits to the general district rate. The railway companies objected, as under the

present system they get a considerable benefit, inasmuch as they contribute less to the district than to the borough fund. Having in view the fact that the railway companies are large consumers of gas, the Corporation brought up a proviso by which the companies would remain in the same position as hitherto; the idea being to credit them with an amount which would leave them financially in the same position as if the existing arrangement were to continue.

Mr. KNIGHT said the objection to the clause was that it introduced a further complication into the rating. Rating law was already sufficiently complicated. Agricultural land and canals were on the same footing as railway companies, and yet the latter were to be placed in a separate category. What was the advantage in the change at all?

Mr. VESEY KNOX said there were certain advantages on the question of accounts and also, he believed, as regards income-tax. As to agricultural land and canals, these were not gas consumers.

The Committee allowed the clause.

LEGAL INTELLIGENCE.

THE CARDIFF COAL CONTRACT DISPUTE.

Yesterday (Monday) Mr. JUSTICE LUSH delivered judgment in the action of *Taylor v. Cardiff Gas Company*, which was tried before him and a Special Jury at the Glamorgan Winter Assizes, as reported in the "JOURNAL" last week, p. 680.

The action was brought to recover the price of certain coal; and the Company, while admitting the claim, counterclaimed for some £1100, the difference between the contract price and the market price of coal they had bought elsewhere. Plaintiff relied on an "accident" clause in the contract as relieving him of liability in respect of the claim by the Company; and the Jury found there had been an accident which interfered with the working of the coal, and that the Company had notice that the working had been interfered with by water.

His LORDSHIP said he postponed judgment in order to have an opportunity of carefully considering the terms of the contract, and the judgment of the Court of Appeal. "Stoppage" did not mean total and complete stoppage, but "substantially interfered with." He thought there was evidence on which the Jury could come to the conclusion they did. It would be putting too narrow a construction on the contract to hold that unless the whole of the works at the colliery were stopped Taylor was not entitled to relief. It was not without some hesitation that he had come to this conclusion. Judgment must be entered for Taylor on the claim and counterclaim, with costs.

On the application of the Company's Counsel, a stay was granted.

An Application to Use German Patents.

In accordance with the notice which appeared on p. 677 of last week's "JOURNAL," there was heard in the Patents Court on Wednesday an application by Mr. S. N. Wellington, of Mincing Lane, E.C., for a licence to use six German patents in connection with Munich chamber carbonization plant. It was stated that this licence was required to carry out an installation, to cost practically £50,000, for the Stockport Corporation. Messrs. R. & J. Dempster were to instal the plant, which was to be entirely British made; and they would do this in association with Mr. Wellington, who had acquired great experience in this class of work. In the Munich system, the charging and discharging of the chambers were effected by gravitation. The principle involved was "epoch making," and very clever, and effected a great saving in manual labour. The quencher was an important part; some 5 tons of incandescent coke being delivered into the receptacle at one time. The gas-tight doors (of which 28 would be required for the Stockport installation) were quite novel, and very heavy; the weight of each being no less than 4 tons. The Comptroller intimated that he would report to the Board of Trade on the application.

Murder by Gas.

At the Birmingham Winter Assizes, on Monday of last week, Robert Speerli, a tailor, was sentenced to death (with, however, a very strong recommendation to mercy on the part of the Jury), for the murder of his daughter under peculiarly distressing circumstances. It was stated that Speerli was a Swiss subject; and as the winter came on, he was unable to get work, his nationality being to some extent against him. Having an invalid wife, who was in hospital, he was left alone with the child, who was about eight years old, and of whom he was very fond; and he struggled on until the house was practically devoid of furniture, and despair had driven him (in the words of the Jury) to such an extraordinary stress of mind that his condition was bordering on insanity. While in this state, the unfortunate man, as evident from letters he wrote at the time, determined to put an end to his life and that of the little girl; and in the case of the child he succeeded. His own statement to the police when arrested was: "I have done something bad. I have caused the death of my child; and I have informed the Coroner. She has been ill. I thought she would be better off. I got a piece of piping on the gas burner, and put the end in her mouth."

Stockport and Additional Capital Expenditure.—According to the printed minutes of the Stockport Corporation Gas Committee for February, and confirmed at the March meeting of the Town Council, it appeared that the present loan for mains and services was practically expended. It was resolved that the matter be reported to the Finance Committee, and that they be requested to make application to the Local Government Board for sanction to borrow £12,000 for mains and services—the estimated requirements for three years.

MISCELLANEOUS NEWS.

PORTHCAWL GAS-WORKS TRANSFER.

Award in the Arbitration.

As the result of the arbitration proceedings which took place in London some weeks ago, and were reported in the "JOURNAL" at the time [*ante*, pp. 264, 336], the Umpire, the Hon. J. D. Fitzgerald, K.C., has awarded the Porthcawl and District Gas Company the sum of £30,396 for the purchase of their undertaking by the Urban District Council. The amount claimed on behalf of the Company was something over £52,000; while the valuation of the Council's witnesses was £21,000 odd.

The terms of the award were made known on Wednesday morning at a special meeting of the Council. When the Clerk stated that the price was fixed at £30,396, the members expressed their satisfaction, and the Chairman said the town had good cause for rejoicing.

THE SUGGESTED WAR BONUS AT MANCHESTER.

Question Deferred for a Month.

The Manchester City Council met last Wednesday, to consider the recommendations of the conference of Chairmen and Deputy-Chairmen of Committees that, in order to meet to some extent the increased cost of living, a war bonus of 2s. per week should be given to every adult employee of the Corporation receiving less than 40s. per week. As stated in the "JOURNAL" last week [p. 683], the recommendation was subject to several conditions. With regard to the Gas Department, the number of men affected totals 1560; and the aggregate cost of the bonus (if granted) represents an outlay of £7800 net per annum. In previous discussions on the question, there had been expressed two distinctly opposite contentions—one that municipal employees, being in safe and steady employment, should be satisfied to continue without advances of pay; the other that, as the cost of food has advanced, the rewards of service should be increased by a corresponding amount.

Mr. HISLOP opposed the proposal *in toto*. He objected to the employees of the Corporation receiving a war bonus; for their employers were not making huge profits, and the men were not working at high pressure.

Mr. ROSS CLYNE (a member of the Gas Committee) moved, as an amendment, that the matter be considered six months hence. He complained that it had been rushed. There was no immediate necessity for the proposal contained in the recommendation. Corporation employees got better wages than other workmen.

Alderman KAY (the Chairman of the Gas Committee) said he could not support the recommendation. It would only make the position in the Gas Department all the more difficult. The increases recommended did not cover their position, for many of their men were earning 6s. a shift, and were working not less than seven shifts; so that they did not come under the conditions of the increase. Without the recommendation, they might have settled their own trouble weeks ago. The scheme as contained in the resolution was unworkable, because it did not include the semi-skilled workers, who, if the proposal was carried, would have a distinct grievance.

On a vote being taken, Mr. Ross Clyne's amendment was defeated by 77 votes to 20, after which

Mr. W. T. DAGNALL (the Chairman of the Electricity Committee) moved another amendment, that the matter be referred to each Committee for consideration, and that their report, and a report from the Finance Committee, be presented at the next meeting of the Council.

The amendment was carried by a large majority.

BURNLEY CORPORATION GAS DEPARTMENT.

Price of Gas Increased.

At a Special Meeting of the Burnley Town Council last Wednesday, for the purpose of considering the annual statement of the Finance Committee and fixing the rates for the coming year, it was stated by Mr. Rice (the Chairman of the Finance Committee), in recommending an increase in the rates from 6s. to 6s. 8d., that the Committee advised that the price of gas be advanced 2d. per 1000 cubic feet to consumers within the borough, and 3d. outside, and that the discount to electricity consumers be reduced from 10 to 5 per cent. Turning to the income side of the balance-sheet, he said the profit anticipated on the gas-works was £4470; but they had made only £2620. At the end of March, 1914, the gas, water, electricity, and tramways undertakings owed, in round figures, to the borough fund £40,000. The present revenue balances of £22,774 were too small for the purpose for which they were intended; and the Finance Committee decided that they could not further encroach upon them. To raise the money required, it was considered a proper thing to increase the price of gas to what it was prior to 1911, as the deficiency, he alleged, had largely arisen through loss of gas profits. He also thought the Electricity Committee should provide a little more.

During further discussion, Alderman Hanson expressed the opinion that if there had not been "mismanagement somewhere," the profits of the Gas Department would not have decreased.

Alderman Emmott (Chairman of the Gas Committee), in explanation of the reduced profits, pointed out that the cost of materials, as well as wages, had increased. In 1900, they paid 10s. 3d. per ton for coal delivered at the works, and to-day they paid 15s. 9d. He was in favour of the gas and electricity charges being put up.

It was moved that the price of gas be not increased; but on a division this proposal was defeated, and the original motion was carried.

LABOUR AND THE COST OF LIVING.

A discussion, which was noticed in the "JOURNAL" at the time, took place at the last meeting of the Birmingham City Council on proposals for increasing the wages of Corporation employees (either for the duration of the war or to a minimum for all circumstances); and it was determined that the General Purposes Committee, with the addition of three labour men, should go carefully into the whole question. The General Purposes Committee, in their turn, appointed a Sub-Committee, chosen mainly from the representatives of the principal employing departments of the Council. This Sub-Committee duly presented their report, whereupon the General Purposes Committee passed the following resolutions:—

1.—That, in consequence of the high cost of living, due to the war, it be a recommendation to committees of the Council that all able-bodied male employees who shall have attained the age of 21 be paid a wage of not less than 28s. a week.

2.—The proposed increase not to advance wages beyond a maximum of 32s. a week.

3.—In the case of aged or infirm male employees receiving less than 26s. per week, an advance of 2s. per week be granted.

4.—That all female employees receiving less than 20s. per week be granted a rise of 2s., or a proportion of the amount, according to the number of years worked.

5.—The foregoing resolution is not intended to include clerks, who are being considered by a Special Sub-Committee of the General Purposes Committee, nor to include the employees of the Asylums Committee, police, or fire brigade.

NO WAR BONUS AT OLDHAM.

In connection with the applications from employees in the Gas and Water Departments of the Oldham Corporation for increases of rates of pay, the following official statement was issued at the week-end by Mr. Arthur Andrew, the General Manager of the Gas and Water undertakings. A meeting of the Chairmen and Vice-Chairmen of the several Corporation Committees employing labour was held on Wednesday, to consider the application which had been submitted by the Municipal Employees' Association and the Gas Workers and General Labourers' Union for an all-round increase of wages to be made to cover the increased cost of living. The meeting had been adjourned from the previous week in order that information might be obtained from other towns of somewhat similar size to Oldham, as to the course that was being adopted elsewhere. These returns showed that no decisive action had been taken. A few towns had decided to grant an increase in varying degree, but not to the extent that was asked for. The feeling of the meeting was averse to any increase being given, either as a war bonus or an increase of wages; the grounds being that, generally speaking, the Corporation employees receive quite as good wages as, if not better than, are paid by private employers in the town, and also that they are in receipt of regular weekly wages with practically no deduction for compulsory short time. It was also considered that, if an increase was given, it would have to be borne to some extent by many ratepayers who are not as well circumstanced as the Corporation employees.

The number of workmen affected by this decision is 785—Gas Department 680, and Water Department 105. The term "workmen" in this case includes clerks.

GREENOCK CORPORATION GAS SUPPLY.

The Condition of the Works—Consumers' Complaints.

The difficulty experienced by the Gas Engineer and Manager of the Greenock Corporation (Mr. James M'Leod) in carrying on the operations at the gas-works, were brought under the notice of the Corporation by a report included in the minutes presented by the Gas Committee at the last meeting of the Town Council. The trouble was due to the age and condition of the principal retort-bench; and a cause of constant anxiety to the Committee had been the condition of the valves in one bench of retorts. This bench, the Manager said, should be overhauled in the near future. It was noteworthy that on no occasion had the pressure of gas been reduced no matter how low the stock of gas might have been; and a higher and more uniform pressure over the entire area of supply had been successfully maintained throughout. This was made clear by the fact that complaints which had fallen at June 30 last by 30 per cent. over the previous year, had again fallen by no less than 55 per cent. up to date. The charging and drawing machines and coal-breakers had demanded very considerable repair, and a serious breakdown was that of the piston of the compressor. The work on the vertical retorts was brought to a gas-making stage in December, when two retorts came into operation, and 28 of the 32 retorts were now producing gas. It was expected that a more uniform illuminating power would be kept up by means of this plant; and it was thought that there should be no difficulty in approximating to 17 candle power in the new plant if coal was sent forward in qualities and quantities as previous to September of last year.

Dean of Guild Paterson moved the adoption of the minutes, and said the complaints had mostly been of an indefinite character.

Mr. G. A. Shearer, who had a notice of motion that it be an instruction to the Gas Committee to produce gas of 17-candle power in future, said he was rather chagrined at the report, which seemed to him to anticipate his motion; and he protested against it being produced only when winter was almost gone. It was his opinion that too much attention was paid to cookers and heaters. The works were instituted primarily for making gas for illuminating purposes; and he hoped there would be a serious effort towards a distinct improvement.

After a short discussion, the minutes were adopted; and, on the suggestion of the Provost, Mr. Shearer agreed to defer his motion to the June meeting of the Council.

ELECTRICITY CHARGES AND THE WAR.

At the last Meeting of the St. Marylebone Borough Council, Alderman Duncan Watson (the Chairman of the Electricity Supply Committee), in reply to a question, said it was perfectly true that the gas companies were advancing their prices 20 per cent., for the same reason that many other undertakings had had to advance theirs. The position was serious; and had it been possible he would there and then have asked the Council, on behalf of his Committee, to make a general advance of 5 per cent. on their tariffs, in the meantime reconsidering the whole question. Unfortunately, they would this year have to face a deficit. In their opinion, if the London County Council would suspend the sinking fund and the repayment of the Marylebone loans, the electricity undertaking would, in one year, show a profit of £30,000. [In a subsequent interview with our representative, Mr. Watson placed the probable saving as high as £50,000.] The whole matter would be reported upon as soon as possible.

Mr. B. S. STRAUS inquired why the Alderman suggested only a 5 per cent. increase, as against the gas companies' 20 per cent., and was informed that the matter had not yet come before the Committee.

SALE OF THE LEITH GAS-WORKS.

As mentioned in our "Notes from Scotland," the Leith Gas-Works, which were the property of the Edinburgh and Leith Gas Commissioners, were sold last Thursday for £13,000; being £1000 more than the upset price. In connection with this event, it may be interesting to reproduce from the "Scotsman" for the 19th inst. the following particulars in regard to the works and the Company by whom they were established.

Nearly a century ago—to be exact, in 1822—the Leith Gas Light Company was established, under an Act "for lighting the town of Leith and its vicinity with gas, and other purposes relating thereto." It carried on business till 1840, when the Edinburgh and Leith Gas Light Company was formed. The new body then acquired the business of the old Company, and it remained in their hands till 1888, when the undertaking, as well as that of the Edinburgh Gas Light Company, was acquired by the Corporations of Edinburgh and Leith, after which the Edinburgh and Leith Corporations Gas Commission was formed. The site of the Leith Gas-Works extends to about 3¼ acres, and consists of different feus, eight or so in number, which formed part of the Sands of Leith. Indeed, the westmost feu was part of the old Naval yard, and was acquired by the Gas Company in 1840 from the then Marquis of Lothian. To the east of the ground held by the Gas Company was the lane called North Assembly Street Lane, which was intended as an access from Baltic Street to the ground to the north. Ground farther east having been purchased by the Gas Commissioners, they, in 1894, obtained parliamentary power to acquire the ground of that lane and to close it, in consideration of their undertaking to make a road at the east end of the new purchase when called upon by the Dock Commission. This new road has not yet been made. It is, of course, in consequence of the erection of the gas-works at Granton that the works at Edinburgh and Leith are no longer required for gas-making purposes.

DAVIS GAS-STOVE COMPANY, LIMITED.

The Fifteenth Annual General Meeting of the Company was held last Wednesday, at the Cannon Street Hotel, E.C.

The CHAIRMAN (Mr. H. Addis Price), in moving the adoption of the report, which was noticed in last week's "JOURNAL" [p. 695], said that the Company's business, like other similar commercial undertakings, had felt the effects of the war during the last five months of the year. Up to the end of July, the volume of business in all departments easily eclipsed all previous records: and even after the outbreak of war the demand was well above the normal. By October, however, nearly 30 per cent. of the workpeople had either been called up or had enlisted in His Majesty's forces; and it would be understood how severely the production and consequent output were curtailed. This decreased output in the latter part of the year had its corollary in greatly increased costs of production, which, unfortunately, were not counterbalanced by any increase in selling prices. At the last meeting he referred to the closing of the London works, and the centralizing of the whole of the manufacturing side of the business at Luton. Part of the London works was transferred to Luton during the year, and the necessary additional buildings at Luton were being completed to accommodate the remainder; so that before the end of this year the London works should be entirely vacated. One of the most important developments during the past commercial year had been the removal of the show-rooms from Queen Victoria Street to Oxford Street. The provident fund which was inaugurated last year had had a very heavy strain to sustain in the grants made to the dependants of those who have joined the Colours. To meet this, it was proposed to allocate £1500 out of this year's profits. It was difficult during the abnormal times through which they were passing to make any accurate forecasts for the future. The costs of all materials, without exception, had considerably advanced in price—in some cases as much as 40 to 50 per cent.—in addition to which production is being considerably curtailed through shortage of labour. The situation with which they were faced served, however, to substantiate the policy the Directors have adopted in the past, of husbanding and consolidating the financial and commercial resources, so that the business to-day was on so solid and permanent a foundation that they could look forward to the future with equanimity.

Mr. HAROLD N. DAVIS, in seconding the motion, remarked that the Company had done their share in capturing a part of the enemy's trade, which they had every reason to believe they would be able, not only to retain, but to still further develop after the war was over.

They had been since the outbreak of hostilities doing, both directly and indirectly, a considerable amount of work for the Admiralty and War Office; and the men were working loyally and well in order to cope with the Government's requirements. Not only had such a large proportion of the men enlisted, but the great majority of them were those who could least be spared. This resulted for a time in serious disorganization; but the position was improving. The difficulties of the Directors in this direction would have been well-nigh insurmountable but for the loyal co-operation they had received from both staff and workpeople.

Mr. CYRIL G. DAVIS, said that evidence of the Directors' confidence in the future was to be found in the removal of the London showrooms and sales department to the commodious premises in Oxford Street, where a permanent exhibition of gas appliances had been arranged. The aim in establishing this exhibition had been to emphasize, under the most favourable conditions of atmosphere and space, firstly, the unrivalled domestic utility of gas and gas apparatus; and, secondly, the as yet largely unrecognized decorative possibilities of the latter. It was, of course, one thing to inspect gas appliances under the usual show-room conditions, but quite another to see them amid refined and dignified surroundings such as those in which the Company's extensive salons enabled them to show them. The entire exhibition was of lively interest; and he felt every justification in saying that no possessor, or prospective possessor, of a home could possibly visit the Company's salons without feeling an increased respect for gas and its various domestic uses. By general consent, such an exhibition had for long been an urgent need of the gas industry. In any survey of the Company's work, it ought not to be overlooked that the present popularity of the gas-fire, and its now general acceptance in medical circles, were due almost entirely to the pioneer work of this Company. In 1911, their own technical expert, after considerable research, determined and gave practical shape to the principles underlying the hygienic efficiency of gas heating by inventing the hygienically perfect gas-fire, and devising the now well-known Davis "Shadowgraph" test. The principles then established were translated into a definite and clearly expressed formula of hygienic efficiency; and it was this standard (originated by the Company, and accepted after searching investigation by the industry at large) which now governed the hygienic status of the gas-fire—so much so that practically every gas-fire maker was to-day making gas-fires on the principles of construction advocated by the Company in 1911.

Stopcocks for Houses.—With the idea of putting an end to the constant breaking-up of streets in connection with the supply of water to houses, the Metropolitan Water Board last Friday adopted a scheme whereby, with the co-operation of householders, stopcocks will be provided to each house at a fixed charge of 15s. Besides obviating the breaking-up of the streets, these stopcocks will enable householders to have the supply temporarily cut off when repairs are necessary indoors. The scheme is not compulsory.

RICHMOND GAS STOVE AND METER COMPANY, LIMITED.

The Twenty-Fourth Annual General Meeting of the Company was held at Warrington on Thursday, the 11th inst., as briefly recorded in last week's issue of the "JOURNAL."

The CHAIRMAN (Mr. T. Dwerryhouse), moving the adoption of the report, said the year just closed, though favourable to the Company, as shown in the balance-sheet and accounts, had been an anxious one for the Directors, especially during the latter part. They began well, and were going on in every respect as well as they could wish when war was declared. They were gratified to find, after some weeks of war, that there was very little alteration in the business. An element of disturbance arose later, when the country called for recruits for the Army. A number of men (about 300 up to the present date) left to join the forces, causing considerable inconvenience. A weekly sum was allowed to those having dependants. The new buildings at Grappenhall had made considerable progress towards completion. The balance-sheet was the best he had seen of this Company, and was a sound one.

Mr. H. M. THORNTON (Vice-Chairman and Managing-Director), in seconding the resolution, said that the war had so altered the conditions of business in this country that it was almost impossible to adequately convey what the operations during the year 1914 had been. The Company were fortunate, however, that the business was one manufacturing almost everything in the nature of gas apparatus which could be considered really necessary for domestic and industrial use. The gas-cooker, which had always been an important part of the business, had long ago established itself as an economical and labour-saving appliance. The facilities offered for cleanliness and quickness in use, which the Company had always made leading features in their designs, had never been more valued and valuable than during the last few months, when unfortunately so many wounded and invalided men had returned. The gas-fire also had become a necessary part of domestic equipment. During the last few years their laboratories had steadily applied every known science to the improvement of gas-fires; and one of the firm's latest achievements was a gas-fire which was silent when burning. This improvement—which they were the first to introduce and bring to a successful issue—had greatly added to the popularity of their gas-fires. This feature of silent burning was considered such a decisive advance that the "Lancet"—which was recognized as the leading Medical Journal—published an article fully describing the fires. Yet another feature of their fires was that, when fixed under usual and proper conditions, all products of combustion left the stove only by the flue-outlet. The present extensive use of gas-fires and all domestic gas apparatus was, however, not due entirely to the improvements which he had mentioned, but to the consistent, persistent, and convincing advertising of the Britsh Commercial Gas Association. As a member of the Executive Committee, he was able to say that this Association had continued to honestly and carefully explain by every

"MAIN" Cooker Hygiene.

FUMES from Cooker Hotplate Burners usually escape into the Room. In small dwellings this is disagreeable, and repels otherwise likely consumers.

You can overcome this objection by using Main's Cooker with closed-in top and flue attachment to the hotplate as well as to the oven. Send for a sample for inspection.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N. Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

legitimate means the many advantages of the various types of apparatus at present available for use with gas. The gas industry and they as manufacturers recognized very fully the importance of supporting an Association which appealed to the public so forcefully and successfully. It would be gratifying to the shareholders to feel that they were interested in a Company which had supplied, and were supplying, a very important and almost overwhelming demand for industrial gas appliances. Many of these were used in the preparation of armaments, transport vehicles, and, in fact, almost every part of the naval and military equipment. Their business in gas-furnaces, which for several years had been steadily growing, had since the war commenced been largely increased; and it was quite clear the output of many things required by the forces had been speeded-up and increased in quantity by the aid of Richmond's gas-furnaces. One instance out of many which he could mention would give some idea of the national value of industrial gas. A well-known firm making musical instruments found the demand for their manufactures almost stopped owing to the war. They had large premises and splendid machinery. They immediately turned their attention to the possibility of manufacturing ammunition; and with the advice of the Company were able to give them as to the use of gas-furnaces, and the installation of a very big battery of these appliances, they were to-day one of the largest suppliers of ammunition to the Government. The Company had equipped a considerable number of temporary hospitals, barracks, &c., with gas cooking and heating appliances, geysers, boilers, &c. The officials, staff, and workmen had supported them splendidly during a very difficult period.

Mr. J. A. RANSOME (Managing-Director), acknowledging a vote of thanks to the officials and staff, said the conditions which existed during the latter part of the year were exceptional and difficult; but it was often said that difficulties were made to be overcome, and their balance-sheet had produced conclusive proof that the Company had overcome their difficulties. Owing to the extremely awkward conditions that had prevailed, a great deal of extra work had fallen upon the shoulders of those who had been left behind.

Gas Explosion at Sunderland.—On Friday afternoon the front was blown bodily out, and other damage done, to a house in Sunderland, by a gas explosion, due, it was thought, to an escape of gas from the main. The premises were occupied by two families; and five persons were somewhat injured.

A Low Price at Wrexham.—Presiding at the meeting of the Wrexham Gas Company, Mr. J. O. Bury said the Company's charge for gas was the lowest in Wales; but he was afraid they might have to increase it, as they expected to have to pay still more for coal and other materials owing to the war. The number of employees who had joined the Colours was eight. During the year 18 tons of copper coins had been collected from the prepayment meters. It was decided, on the Directors' recommendation, to pay a dividend at the rate of 5 per cent. per annum.

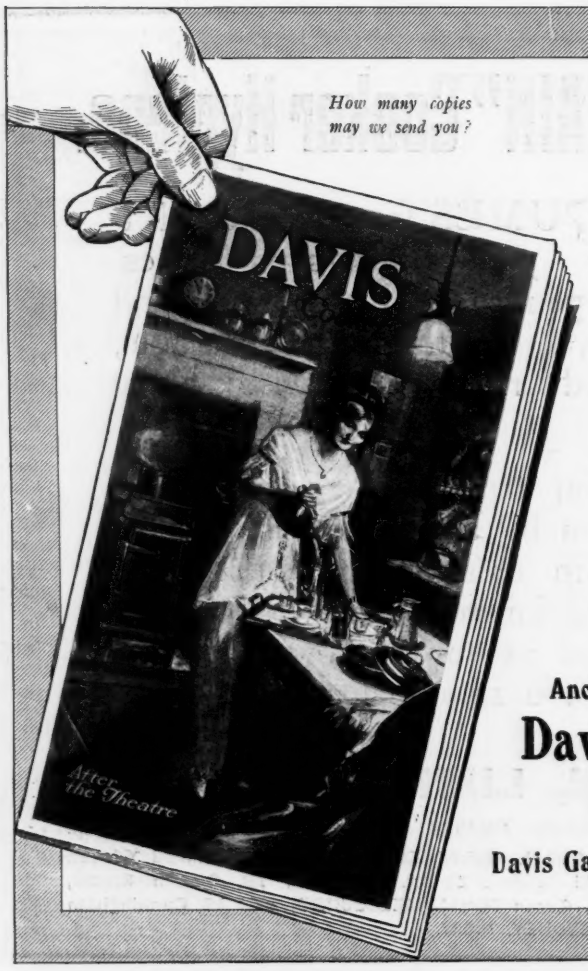
NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

At the meeting of the Edinburgh and Leith Gas Commissioners on Monday, the Works Committee reported that at a meeting of the Sub-Committee appointed to deal with the sale of the Leith Gas-Works an offer of £10,000 had been received. They instructed the Clerk to reply that the Commissioners would be prepared to expose the subjects to public sale if a firm offer were sent in to bid the reduced upset price of £12,000. These instructions were given as the result of a motion by the Convener (Judge Lindsay as against an amendment moved by the Convener of the Finance and Law Committee (Bailie Lyon), that the offer of £10,000 should be rejected *simpliciter*. Having considered an inquiry as to the price expected for the site of the Edinburgh Gas-Works, the inquirer to have the option to purchase within three months, the Sub-Committee instructed the Clerk to reply that the inquirer might have a month's option at the price of £30,600. The desired offer for the Leith works having been sent in, the subjects were advertised for public sale on the following Thursday, at the reduced upset price of £12,000. As a matter of fact, the works were sold, at the auction, for £13,000; the feu-duty being £51 10s. Bidding for the property was confined to two gentlemen. It is understood the site will be used in connection with the business of a local timber merchant. As to the Edinburgh works, the Works Committee authorized the inquirer to have the option for three months, which he still desired—he paying £250 if the offer was withdrawn by the 1st of June. This minute was ratified generally; but at a private meeting after the conclusion of the ordinary business it was resolved to depart from the resolution as to the payment of the fine.

At the close of the business on the *agenda*, Bailie Stark raised the question of the allowances to be paid by the Commissioners in respect of employees serving with the Colours. In the case of one man, it had been the custom to pay 5s. 6d. per week; but, in view of the increased Government allowances, this amount had been reduced to 5d. The Bailie strongly objected to the Commission taking advantage of the Government increases to limit their own payments, and held that such an increase was tantamount to promotion. He further held that it had been already decided that a man was to get the benefit of any promotion. On the last point considerable doubt was expressed, which the minutes on the subject did not seem to remove. After some remarks, the Treasurer and Collector (Mr. A. Canning Williams), on the invitation of the Lord Provost, explained that in the case of a member of his staff who joined as a private, but quickly rose to the rank of sergeant, the method followed had been to deduct only the sum taken at the time the man joined. This step was in accordance with the practice followed by the Edinburgh Corporation. But they looked on increased separation allowances as something different from promotion. Eventu-



"A good advertisement for GAS"

THE Davis Summer Booklet (now ready) is as good an advertisement for Gas as it is of DAVIS Cookers and Summer Gas Appliances generally.

For this reason, its distribution amongst likely Consumers is well calculated to stimulate Gas Sales and to repay abundantly the enterprising manager's interest in its purpose.

Inquiries for quantities, and matter for free imprinting, will be gladly welcomed.

Another good advertisement for GAS is the

Davis Permanent Exhibition

60, Oxford Street, London, W.

Davis Gas Stove Co., Ltd., London, Luton, Manchester, Paris.

ally the subject was, with the approval of Bailie Stark, remitted to the Works Committee.

On Saturday, the 13th inst., a large company assembled in the Victoria Hall, Almondbank, to witness the turning-on of the supply of gas from Perth, which has been extended to the district. Mr. J. D. Lumsden presided. Ex-Bailie Wright, the Convener of the Gas Committee of the Town Council, explained the circumstances leading to the introduction of Perth gas to Almondbank, and said that in the district out of 170 householders only six refused to take a supply. In Pitcairngreen, which adjoins, 50 residenters wanted the gas; while applications for a supply had been made by the neighbouring villages of West Huntingtower and Methven. Mr. Wright then turned on the first light; and the company were afterwards entertained at tea. During the afternoon and evening lectures on gas cooking were given by Miss Dods; while there was a special exhibition of lighting and heating appliances.

It has been decided to alter and modernize the works of the Maybole Gas Company, at the cost of £1000.

Agitations for increased wages are going on all around. In Dundee two labour disputes are already in progress, and on Monday the labourers and lamplighters employed in the Gas Department lodged a demand for higher pay. In the case of the labourers, application was made for an increase of 1d. per hour on the present rate of wages, time-and-a-half for overtime, and double pay for Sunday labour. The demand was refused. The lamplighters' request was for an advance of 1d. per hour. This request was not granted; but the stairlighters will have a bonus of 2s. per week. The present rate of wages of the labourers in the Gas Department is from 25s. 6d. to 27s. 8d. per week, while the lamplighters receive from 26s. 3d. to 28s. 9d.—exclusive of the war bonus of 1s. a week offered by the Corporation. In answer to a demand for an increase of wages, the stokers in the Airdrie Corporation Gas-Works have received an advance of 3d. per shift, and the labourers 1s. 2d. extra per week. The Sub-Committee of the Glasgow Corporation who have been considering the question of wages, on Monday agreed to recommend the payment of war bonuses to certain employees. They did not favour any general increase being granted, but suggested that the following bonuses should be given: Employees earning up to and including 27s. per week, 3s. per week; those earning over 27s. and up to and including 30s. per week, 2s.; and those earning over 30s. and up to and including 40s., 1s. per week. Employees on the grading scheme and those working on Trade Union conditions are excepted from the recommendation.

Price to be Raised at Coventry.—On account of the large increase in the working costs, due to the rise in the price of coal and increased wages, the Coventry Gas Committee have decided to recommend the Town Council to increase the price of gas by 4d. per 1000 cubic feet throughout the scale, the increase to take effect from the next reading of the meters.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *March 22.*

There is very little change to report in the London market for tar products. The considerable fall that has taken place already in freights should lead to a corresponding improvement in the value of pitch at all ports. On the other hand, there appears to be some doubt whether local authorities will spend in the coming season so much money on tar and pitch for roads as formerly. Sixties crude carbolic acid is in strong demand, and 3s. 6d. net, casks free, is offered for it. Solvent naphtha is also in great request. Creosote is in a healthy position, with large inquiries; and the price is about 4½d. net per gallon in bulk.

Something like a lull has come over the sulphate of ammonia market; but this does not matter, as makers are practically sold out for early delivery. The export of this article had been prohibited; but this official step need cause no alarm, as no doubt licences to ship will be granted for approved transactions.

Tar Products in the Provinces.

March 22.

The markets for tar products have remained fairly steady throughout the past week. Benzol maintains its price, and there is a little inquiry for both prompt and forward delivery. Solvent and heavy naphthas are in good demand, and very good prices have been paid for both qualities. There has also been a slight improvement in crude carbolic for both prompt and forward delivery. Creosote is weaker, and fair quantities have been offered during the past week at lower prices.

With regard to the price of crude tar mentioned last week, it should be stated that deductions were not made for special circumstances. The price should have read 20s. 6d. to 24s. 6d.

The average values of gas-works products during the past week were: Tar, 21s. to 25s.; pitch, East Coast, 17s. to 17s. 6d.; West Coast, 18s. to 19s., Manchester; 19s. to 19s. 6d., Liverpool; 20s. 6d. to 21s. Clyde. Benzol, 90 per cent., naked, North, 9½d. to 10½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 2d. to 2s. 4d. Crude naphtha, in bulk, North, 5¼d. to 5⅜d. Solvent naphtha, naked, North, 1s. 5d. to 1s. 6d. Heavy naphtha, naked, North, 11d. to 1s. Creosote, in bulk, North, 3⅛d. to 3¼d. Heavy oils, in bulk, 3⅝d. to 4d. Carbolic acid, casks included, 60 per cent., East and West coasts, 3s. 4d. to 3s. 5d. Naphthalene, £7 to £12; salts, 65s., bags included. Anthracene, "A" quality, 2d. per unit.

Nitrate of Soda.

The tone of this market is again firmer, and holders now require 11s. 6d. per cwt. for ordinary quality, and 12s. for refined, on spot.

Careful attention will be given to YOUR enquiries.

R. & J. DEMPSTER, Ltd., MANCHESTER.

London Office:
165, GRESHAM HOUSE,
Old Broad St., E.C.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *March* 20.

During the past week there has been no improvement in the demand for this article, either for use in the United Kingdom or for shipment to foreign countries. Consequently, the market has remained inanimate, and it has only been possible to effect further sales by accepting reduced prices. The nearest values at the close are £13 10s. per ton f.o.b. Hull, £13 10s. per ton f.o.b. Liverpool, and £14 per ton f.o.b. Leith. There has not been much activity in the forward position, but it is reported that some business has been done at £13 2s. 6d. per ton f.o.b. Liverpool for delivery over the second half of the year.

Sulphate of Ammonia.

From another source it is reported that the market for this article is still very quiet, and does not show any immediate signs of improvement. Outside London, makes are still quoted at £12 17s. 6d to £13; Leith, £13 17s. 6d.; Liverpool, £13 16s. 3d. to £13 17s. 6d.; Hull, £13 12s. 6d. to £13 15s.; Middlesbrough, £13 12s. 6d. to £13 15s.

COAL TRADE REPORT.

Northern Coal Trade.

The northern coal trade has been rather excited; but the stormy weather has had an effect on the shipments of coal, and thus on the work at some of the collieries. In the steam coal trade, the demand is urgent; and where early delivery is needed, prices are very firm. The approach of the holidays may also further stiffen rates. Best Northumbrian steams are nominally about 27s. 6d. per ton f.o.b.—a price which is not much short of double that quoted a year ago. Steam smalls are also relatively high, with large sales forward. In the gas coal trade, prices show a further advance. Best Durham gas coals are now from 16s. to 16s. 6d. per ton f.o.b.; second-class gas coals are quoted from 15s. to 15s. 9d. per ton; and "Wear Specials" are near 17s. per ton f.o.b. The large sales of other classes of Durham coals at high figures have had an effect on gas-coal prices; and there is also the result of the comparative scarcity of Durham coals owing to the lack of labour through the enlistment of miners. There is, however, some further ease in the freight market; the market rate for gas coals from Tyne to London being now down to 8s.—a sharp fall from the rates of a month or so ago. The fuller arrival of steamers may give further ease in this direction. In coke, prices are firm. Good gas coke may be put at about 12s. to 13s. per ton f.o.b. in the Tyne; the stocks being lower.

Testing of Gas-Meters.—According to the annual report by the Board of Trade on proceedings under the Weights and Measures Acts, the number of gas-meters tested by inspectors during the year 1913-14 was 927,461.

Coke Prices at Stockport.—At a recent meeting of the Stockport Gas Committee, the rapid increase in the price of coke was commented upon by some of the members. Mr. Royle said the increases were hitting the poor people very badly, and especially those who could not afford to pay the existing prices for coal. Mr. John Winter (the Chairman of the Gas Committee) replied that the price of coke was regulated by the Manchester Corporation Gas Department. They at Stockport had to quote for coke according to the market price. There was a special arrangement by which poor people who were supplied with food tickets could be furnished with coke. As a matter of fact, the present-day demand for coke was greater than they could supply. Care was taken that the coke was not sent out of the district.

Leeds and a Gas Supply for Thorner.—A Local Government Board inquiry has been held at Leeds into an application by the Corporation for a Provisional Order for various powers, one of the requirements being to supply gas to Thorner, in the Wetherby Rural District. Representatives of the Wetherby Council, however, attended, and intimated that their Council did not support the application. Sir Robert Fox (Town Clerk of Leeds) said an application was received from Thorner last September, asking on what terms the Corporation could supply the place with gas, and a figure was quoted. Since that time nothing had been heard. They had desired to treat Thorner in a friendly spirit; but if Thorner did not want the scheme, the Corporation did not want it either. The representatives of the Wetherby Council expressed regret that the misunderstanding should have arisen. The proposal was dropped.

Cromer Gas Company.—At the meeting of this Company last Tuesday, the accounts for the past year showed a balance of revenue of £1233. After charging £551 for interest and income-tax, £15 15s. contributed to the War Relief Funds, and writing-off £600 from the suspense account, there remained a balance of £183 to the credit of the profit and loss account. Owing to the circumstances arising out of the war—the exodus of visitors and the reduction of lighting—the sale of gas was diminished to the extent of 153,400 cubic feet compared with the previous year. Moreover, the cost of nearly every article required for carrying on the business of the Company had been greatly enhanced; and the Directors, in their report, expressed regret at not being in a position to recommend the payment of a dividend. In moving the adoption of the report, the Chairman (Mr. E. L. Burton) remarked that the reduction of only 0·5 per cent. in the sale of gas seemed almost marvellous, because during the autumn and down to near the end of the year there was practically no one in the place. That the reduction was so little was largely, if not entirely, due to the splendid work and energy of their Manager (Mr. F. Smallbone), in whom the Company had an excellent living, earning asset. The Directors had decided that for the current quarter the price of gas would be 4s. 5d., instead of 4s. 1d. per 1000 cubic feet. The report was adopted; and a vote of appreciation was accorded to Mr. Smallbone for the assiduity and ability with which he had managed the business of the Company during the past year.

HOSPITAL COOKING HEATING HOT WATER EQUIPMENT

ARDEN HILL'S GAS-HEATED COOKING APPARATUS INSTALLED AT THE 1ST EASTERN R.A.M.C. HOSPITAL, CAMBRIDGE.

ROASTING OVENS
BAKING OVENS
BOILING TABLES
SOUP BOILERS
HOT CLOSETS
CARVING TABLES
HOT WATER SUPPLY
GAS RADIATORS
GAS FIRES
&c., &c.

Please send us particulars of requirements, when we will submit proposals, with estimates for suitable apparatus, by return of post.

ARDEN HILL & CO., ACME WORKS, BIRMINGHAM.

Winsford Urban District Council Gas Undertaking.

In presenting to the Chairman and members of the Winsford Urban District Council the working statement in connection with the gas undertaking for the year ended March 31, 1914, Mr. F. Sidwell (the Gas Manager) states that the make of gas for the year was 35,499,700 cubic feet—an increase of 1,790,200 cubic feet, which equalled 5·31 per cent. When the works were taken over in 1901, the make was 15,136,500 cubic feet; and the increase since then equalled 133·86 per cent., or 10·29 per cent. for each year. The quantity of gas sold to consumers was 31,345,488 cubic feet, being an increase of 1,573,800 cubic feet, or 5·27 per cent. The gas unaccounted for was 2,360,292 cubic feet, or 6·36 per cent. In the year 1901, the gas unaccounted for was 20 per cent. The quantity of coal carbonized in the year under review was 3203 tons; the make per ton being 11,238·66 cubic feet. The residuals showed a gratifying increase of £147. As to new consumers, 57 were connected-up. The present prices are 2s. 6d. per 1000 cubic feet by ordinary meter; 2s. 7d. by prepayment meter; and 2s. for power.

A Bonus Scheme at Bradford.—The Bradford City Council, at a special meeting last week, convened for the purpose of considering the question of wages and salaries of Corporation servants in view of the increased cost of living, decided to meet the difficulty by a scheme of bonuses operative for a period of six months from the 1st inst. For the six months, the cost of the scheme will be £15,000—a sum equivalent to rather less than an addition of 2½d. in the pound on the rates. At the end of the time named, the matter will be considered afresh.

Death from Gas Poisoning.—An inquest was held some days ago into the circumstances attending the death of John Kingdom (aged 73), of Bristol, who died from the effects of gas poisoning. He was heard making a peculiar noise in his room, and when the door was burst open was found lying on the bed apparently dead. There was a strong smell of gas in the room, and in it was found a gas-ring, with gas escaping from it. It was thought deceased got out of bed during the night to make himself a cup of tea, as he was heard moving about, and must have accidentally turned the gas-tap on again. A doctor on arrival pronounced life as extinct. A verdict of "Accidental death" was returned.

Wombwell Gas Supply Area.—A Local Government Board inquiry was held last week at Wombwell, in the Yorkshire mining area, into the Urban Council's application for powers to extend their area of gas supply to Great and Little Houghton, two villages which are in the Hemsworth rural district and beyond the Darfield urban district, which is already supplied by Wombwell. At Great and Little Houghton the houses are lighted by oil-lamps, and there are no public lamps. The application was opposed by the Chairman and Clerk of the Little Houghton Parish Council, who said the Houghton Main Colliery Company proposed to light the village with electricity; but it was admitted that, though the resolution on this matter had been passed two years ago, nothing had yet been done.

Torquay Gas Company.

The annual meeting of the Torquay Gas Company was held last Wednesday, Mr. A. Iredale (the Vice-Chairman) presiding, in the absence, owing to military duties, of the Chairman (Captain R. P. Kitson. In moving the adoption of the report and accounts, Mr. Iredale said that 19 members of the staff and employees had joined the forces, including the Assistant-Manager (Mr. Irving) and the Manager's son (Mr. Hugh Beynon). Their places were being kept open for them; and the Company were contributing to the support of the wives and dependants of those who were married. The difficulty of obtaining coal had been a matter of increasing and pressing anxiety to the Directors; and the price had gone up to a figure which exceeded all previous records. The cost of oil had also increased, while wages had an upward tendency, and rates and taxes were always on the up-grade. Another adverse factor was the decline in the price of residuals, on which they had suffered a heavy loss in the past year. As the result, the Directors were reluctantly compelled to increase the price of gas at the commencement of the year; and they might be obliged to add to it still further. The total receipts were £36,868, an increase of £220; and the expenditure was £31,154, as against £29,153. The balance carried to profit and loss account was £5613, against £7491. The amount standing to the credit of the profit and loss account was £10,221. Payment of the usual dividend would absorb £3268. There had been an increase in the sale of gas of £614, constituting another record; and if normal conditions had prevailed, the Company would be enjoying great prosperity. Dividends were declared of 10 and 7 per cent. on the two classes of shares.

Smethwick Gas Committee Chairmanship.—The Smethwick Traders' Association have passed a resolution placing on record their high appreciation of the services rendered to the gas undertaking by Alderman Pinkney, who had been compelled to relinquish the chairmanship through ill-health. The Secretary has been instructed to write to Alderman Pinkney expressing the views of the members, and thanking him for the sacrifices he had made in order to render such signal services to the undertaking.

A War Bonus Granted at Rochdale.—A joint conference of the various Committees of the Rochdale Corporation was held last week to consider applications for increases of wages from employees. In the Gas Department alone the number of men who will benefit is, approximately, 230. At 2s. per week bonus for each of these men who are in receipt of less than 45s. weekly, the total cost works out at £1196 per annum. The matter will come up for confirmation or otherwise at the next meeting of the Town Council; the total bonuses suggested being stated to be equal to a 3½d. rate. The application of the Gas-Workers and General Labourers' Union was for a 4s. per week increase. The Joint Committee were unanimous that present special circumstances demanded some extra pay; but it was felt that the grant should be merely for the period of the war.

The

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39, Victoria Street, LONDON, S.W.

Newton-le-Willows Gas-Works Scheme.

At the last meeting of the Newton-le-Willows Gas Commitee, a discussion arose on the question of proceeding with the new gas-works scheme. Mr. Collingwood said he thought that, in view of the recent expression of opinion from the Treasury as to the expenditure of money, the matter should, if possible, be deferred. It was stated that the scheme involved an expenditure of between £25,000 and £30,000. Mr. Emmett urged that the scheme should be dropped for the present; but the Clerk pointed out that he had gone so far as to enter into a contract with the Woodall-Duckham Company, who had themselves urged that the work should be proceeded with at once, on account of the rising markets. Mr. Goslin moved that tenders be invited for the remainder of the scheme, after which Mr. Borron said he did not feel disposed to vote in a hurried manner for the expenditure of such a sum. Had the Gas Committee had expert advice as to whether the plant would cope with any increased output of gas? Mr. Collingwood moved an amendment that the matter be postponed until a reply had been received from the Local Government Board; but this was lost by five votes to three.

War Bonus Granted at Warrington.—By the decision of a special meeting of the Warrington Town Council last week, over 200 men in the Gas Department will benefit by the receipt of a war bonus over and above their usual rate of pay; the scheme, of course, being confined to those in receipt of wages of and exceeding £1, but not exceeding £2 per week. The proceedings only lasted for a few moments, and were of a harmonious character. The bonus is retrospective to March 1, and varies, according to circumstances, from 1s. to 3s. per week. For the week ending March 13, over 200 men were paid the bonus; the amount being over £23. It is impossible to state what the effect will be over the year, as the Corporation are now installing a power-stoking plant, which will alter their method of working.

Wilmslow Gas Prices Increased.—The Wilmslow and Alderley Edge Gas Company have decided to increase the price of gas 2d. per 1000 cubic feet to consumers in the whole of their area, owing to the greatly increased cost of labour and materials and appliances used in the manufacture of gas.

Salary Question at Newton-le-Willows.—The salary of Mr. R. T. Surtees, the Gas Engineer at Newton-le-Willows, was advanced at the last meeting of the District Council by £25 per annum, with an allowance of £25 for the upkeep of a motor-cycle. The Chairman (Mr. E. L. Bent) told his colleagues that he had agreed with Mr. Surtees as to these terms, on the condition that when the electricity scheme came up, his salary should again be considered.

Dearer Gas at Huddersfield.—At a meeting of the Huddersfield Town Council last week, it was resolved that the price of gas should be increased to all consumers—including public and private lighting, heating, and power. In the budget statement which was submitted, it was reported that the gas-works, owing to the high price of coal and the reasonable figures at which gas was sold, were unable to make any contribution in relief of the rates—indeed, there was an adverse balance on the year's working.

Birkenhead Gas-Workers' Strike.—The strike at the Birkenhead Gas-Works continues; but the supply of gas has materially improved, and the officials are now sanguine of being able to give a normal service at an early date. Since the men ceased work, their places have been filled mainly by clerks from the Engineer's office, who have shovelled coal and attended to the gas-producing plant with considerable success. The clerks have been assisted by some members of the "Bantams" Battalion, who are in the main local recruits. The men are fed and housed at the works, and their food is brought in under guard. So far the men have made no overtures to the authorities, and continue to picket at the gates of the works, closely scrutinizing everyone who enters.

GAS COMPANIES IN THE STOCK EXCHANGE.

Business on the Stock Exchange last week was quieter—a feature which was induced by a variety of factors. A disturbing element was the grave unrest in labour circles which threatened to dislocate, almost to the point of arresting, the output of the war material without which the operations of the allied forces could not be adequately prosecuted. Another minor impediment was the issue—rather late in the working week—of the revised list of minimum prices, and which the Treasury seemed to have sanctioned rather grudgingly. Thus dealings towards the close were to some extent suspended. The general tone on the whole was fair. High-class securities and Americans were better; but Rails were not strong. On Saturday, the chief interest centred in the election of the new Committee. The condition of the Money Market was generally easy. Business in the Gas Market shared to the full in the generally prevailing quietude, and it also exhibited some remarkable phenomena in prices. The opening figures had been steady; but later on, when notifications as to rises in the price of gas by Metropolitan Companies came out, a sharp fall was inspired by reflections upon the consequent reductions in the prospective dividends for the current half year. The authorized rates of dividend upon the 4 per cent. stocks are lower by 2s. 8d. per cent. for each increase of 1d. per 1000 cubic feet in the price of gas. Some of the companies were not dealt in after the publication of the advances in price, and consequently these show no fall.

Bargains done for cash during the week were as follows: On Monday, Bournemouth "A" 29½, 29¾, British 41, 41¼, European 12⅝, Gas Light ordinary 90⅜, 91¼, 92, Imperial Continental 82½, 83, South Metropolitan 96. On Tuesday, Gas Light ordinary 90, 90½, 91, ditto preference 90, ditto debenture 69½, 70, Melbourne 99⅜, South Metropolitan 95, 97½, Tottenham "B" 112½, 113. On Wednesday, Aldershot preference 85½, 86, Bournemouth "A" 29½, 29¾, British 41, 41¼, Gas Light ordinary 90, 85, 87½, ditto maximum 70, South Suburban 105½, 106. On Thursday, British 41, 41¼, Gas Light ordinary 87½, ditto preference 85, Imperial Continental 82½, 83, Newcastle debenture 81, Primitiva preference 4 7/16, 4½, 4 9/16, ditto debenture (1911) 77½, 78, South Suburban 105, Tottenham "B" 112½, 113. On Friday, Commercial 4 per cent. 99, European 12 13/16, Gas Light ordinary 87, Primitiva debenture (1911) 77½, South Suburban 92. On Saturday, European 13, Gas Light ordinary, 86, 86½, 87, ditto preference 85, South Suburban 92½.

Bank rate (fixed Aug. 8) 5 per cent.; last year, 3 per cent.

LOWEST AND HIGHEST PRICES OF BARGAINS DONE FOR CASH IN THE WEEK ENDING MARCH 20.

Issue.	Share.	When ex Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p c.			£ s. d.	
1,551,868	Stk.	April 8	2½	Alliance & Dublin Ord.	59—64	3 18 2	..
374,000	,,	July 10	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	Bombay, Ltd.	5⅞—6⅝	5 17 8	..
50,000	10	Feb. 26	16	Bourne- 10 p.c.	29—30	5 6 8	29⅛—29¾
373,480	10	,,	7	mouth Gas B 7 p.c.	15—15½	4 10 4	..
95,000	10	,,	6	and Water Pref. 6 p.c.	13¾—14	4 5 9	..
—	—	—	—	Deb.	..	—	..
380,000	Stk.	Feb. 26	14	Brentford Consolidated	261—266	5 5 3	..
330,000	,,	,,	11	Do. New	204—209	5 5 3	..
50,000	,,	,,	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	,,	June 11	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	,,	,,	8	Do. A Ord. Stk.	154—159	5 0 8	..
630,000	20	Mar. 26	13½	British	41—45	5 11 1	41—41½
120,000	Stk.	June 26	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord.	109—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	Commercial 4 p.c. Stk.	106—108	5 1 2	93
560,000	,,	,,	5½	Do. 3½ p.c. do.	103—105	5 1 6	..
475,000	,,	June 11	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	..
800 000	Stk.	,,	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	,,	,,	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
—	—	—	—	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	,,	—	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	European, Ltd.	17¼—18	5 11 1	12⅝—13
16,362,910	Stk.	Feb. 12	1/17/4	Gas 4 p.c. Ord.	98—102	4 15 6	85—92
2,600,000	,,	,,	3½	Light 3½ p.c. max.	76—79	4 8 7	70
4,062,235	,,	,,	4	and 4 p.c. Con. Pref.	96—99	4 0 10	85—90
4,674,850	,,	June 11	3	Coke 3 p.c. Con. Deb.	74½—74¾	4 0 6	69½—70
258,740	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
—	—	—	—	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7⅞†	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6⅜†	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	Imperial Continental	150—160	5 12 6	82½—83
1,235,000	Stk.	Feb. 12	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 6	..
561,000	Stk.	Feb. 26	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	,,	,,	7	Liverpool 5 p.c. Ord. B	146—148	4 14 7	..
306,083	,,	June 26	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..

Issue.	Share.	When ex Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.			£ s. d	
75,000	5	June 11	0	Malta & Mediterranean	4½—4⅝	6 9 9	..
250,000	100	April 1	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	99⅜
541,920	20	May 28	4	Monte Video, Ltd.	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	81
55,940	10	Feb. 26	7/14/0	North Middlesex 7 p.c.	14—15	5 2 8	..
300,000	Stk.	May 14	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	Ottoman, Ltd.	7½—7¾	6 9 0	..
60,000	50	Feb. 26	13	Portsea, Island B	128—131	4 19 3	..
100,000	50	,,	12	Do. C	118—121	4 19 2	..
249,980	5	April 29	8	Primitiva Ord.	5⅛—6	6 18 4	..
499,960	5	June 26	5	,, 5 p.c. Pref.	4⅝—5	5 0 0	4 7/16—4 9/16
521,600	100	June 2	4	,, 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	,, ,, ,, 1911	..	—	77½—78
346,198	Stk.	June 26	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	San Paulo 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	Sheffield A	233—234	4 9 3	..
209,984	,,	,,	10	Do. B	222—224	4 9 3	..
523,500	,,	,,	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	South African	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/9/4	South Met., 4 p.c. Ord.	111—113	4 16 8	95—97½
1,895,445	,,	July 10	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
209,820	Stk.	Feb. 26	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	92—106
60,000	,,	,,	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
—	—	—	—	Do. West Kent.	..	—	..
137,058	,,	June 26	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½†	Tottenham A 5 p.c.	135—138	5 8 8	..
742,275	,,	,,	6†	District B 3½ p.c.	115—117	5 2 7	112½—113
181,255	,,	June 26	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
				Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅜	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	,,	,,	6½	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/8	,, C 3½ p.c.	110—115	5 2 0	..
352,000	,,	,,	6½	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6⅝	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

x Bargains marked thus were "Ex Div."

The Kilrush (co. Clare) Urban Council Gas Committee have applied for a loan of £3500 for reconstruction of plant at the gas-works, and other needed improvements.

The price of gas is to be increased at Exmouth by 3d. per 1000 cubic feet, making the charge to ordinary consumers 3s. 8d. per 1000 cubic feet, less 2d. for prompt payment. The price to users of pre-payment meters will be at the rate of 20 cubic feet for a penny.

At a meeting of the Dewsbury and Heckmondwike Joint Water Board, the Clerk stated that the surplus revenue distributable last year was £6800. In the present year the receipts had been reduced by £200 and the income-tax increased by a similar amount; and the amount available for distribution was therefore £6400. Under the working arrangements, three-quarters of the profits are taken by the Dewsbury Corporation, and the remaining quarter by the Heckmondwike District Council.

The report of the Directors of the New Inverted Incandescent Gas-Lamp Company, Limited, for the year ended Dec. 31, to be presented at the thirteenth ordinary general meeting to-morrow, states that the net trading profit, after allowing for depreciation and all trade charges, is £12,302. The balance of profit, as shown in the profit and loss account, amounts to £11,118, which, added to the sum brought forward from the previous year, gives a total available profit of £12,698. Out of this sum, the Directors recommend that £2000 be added to reserve, and that a dividend be paid at the rate of 6¼ per cent., free of income-tax, which will absorb £6765, and leave £3933 to be carried forward. On Jan. 1, 1914, £1000 was paid off the debentures, and another £1000 was paid off on July 1, leaving £4000 outstanding. On Jan. 1, this was reduced to £3000 by paying off another £1000.

Nothing less than the perfection of the printer's and photographer's art could convey pictorially an adequate idea of the appearance of the new Permanent Gas Exhibit of the Davis Gas-Stove Company, Limited, at No. 60, Oxford Street, W.; and this perfection has been secured in "A Photographic Impression," with the illustrations in colours, which has just been issued by the firm. The booklet is claimed to be "In the Cause of Comfort"—and so it is, for the letter-press draws attention concisely but conclusively to the advantages of gas, both in the home and elsewhere. As to the show-rooms themselves, their excellence has already been commented upon in the "JOURNAL;" and it need only be said now that the Davis Gas-Stove Company, by their enterprise, have deserved well of the whole of the gas industry, and of all those who desire the best forms of heat and light.

In the report to be presented by the Directors of Messrs. C. & W Walker, Limited, at the general meeting on the 1st prox., they state that the profit for the year ended the 31st of January last, and after charging Directors' fees and depreciation on buildings and plant and strengthening the reserves, amounts to £15,657. Adding the balance brought forward, there is a sum of £26,806 standing to the credit of the profit and loss account, which the Directors recommend should be dealt with as follows: To preference and ordinary dividend already paid for the six months ended July 31, 1914, £3100; to payment of a dividend at the rate of 5½ per cent. per annum on the preference shares for the six months ended Jan. 31, £1100; do. at the rate of 10 per cent. per annum, free of income-tax, on the original ordinary shares for a like period, £2000; to payment of a bonus of 1s. per share on ditto, free of income-tax, £2000; to payment of a dividend at the rate of 10 per cent. per annum, free of income-tax, and a bonus at the rate of 5 per cent. per annum on the new ordinary capital, from the dates when the calls were paid, £345 10s.; to be carried to the reserve fund, making it £40,000, £2355 10s.; and to a contingent reserve fund, £4000—leaving £11,905 to be carried forward.

APPLICATION TO AVOID OR SUSPEND ALIEN ENEMY PATENT.

No. 10,446 of 1911.—Grantee, BORNKESSEL, "Blowpipe burners." Applicants, C. MELIN and Co.

APPLICATIONS FOR LETTERS PATENT.

3633.—CAMPBELL, F. W., "Incandescent burners." March 8.
3640.—BOARD, F., "Connecting branch pipes." March 8.
3677.—TESTRUP, N., RIGBY, T., and WETCARBONIZING, LTD., "Bye-product recovery from gas-producers. March 8.
3690.—SOUTH METROPOLITAN GAS COMPANY and BUCKETT, W. J., "Igniting-burners." March 8.
3769.—MANNESMANNRÖHREN-WERKE. "Pipe socket joints." March 9.
3812.—BLYTH, H., "Quenching coke." March 10.
3868.—YATES, H. J., ROSE, A., BELLAMY, W., and DOLPHIN, J., "Atmospheric gas-burners." March 11.
3903.—TULLY, C. B., "Enrichment of water gas." March 11.
3939.—RASCH, L., "Operating gas cocks." March 12.
3964.—KING, W. E., and the GAS-METER COMPANY, LTD., "Controlling lamps." March 12.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

LADY INTERVIEWER AND DEMONSTRATOR. Tyneside Gas Company.
JUNIOR CHEMIST. Birmingham Gas Department.
TRAVELLERS. No. 6004.
RENTAL AND GENERAL CLERK. No. 6007.
GAS-FITTERS. No. 217, c/o Smith's Agency.
STOKER. No. 6008.

Pupil Wanted. No. 6005.

Plant, &c. (Second-Hand), for Sale.

MEGUIN CLUTCH STAMPER. Allerdale Coal Company.
TYPEWRITERS. White, Northampton.
WASHER, ENGINES, AND EXHAUSTER. Blyth Gas-Works.

Plant, Books, &c. (Second-Hand), Wanted.

CRIPPS'S GUIDE-FRAMING OF GASHOLDERS. No. 6010.
VALVES. No. 6009.

Sales of Shares.

GRAYS AND TILBURY GAS COMPANY. London Mart. April 13.
ST. ALBANS WATER COMPANY. London Mart. April 13.

Meeting.

BRITISH GAS LIGHT COMPANY, 11, George Yard, Lombard Street, E.C. March 31. Twelve o'clock.

TENDERS FOR

Buildings (For Carbonizing Plant, &c.).

ASHINGTON URBAN DISTRICT COUNCIL. Tenders by April 17.

Carbonizing Plant.

ASHINGTON URBAN DISTRICT COUNCIL. Tenders by April 17.

Coal.

BRYNMAWR AND BLAINA GAS COMPANY. Tenders by April 7.

Condensing, Washing, Purifying, Exhausting, &c., Plant.

ASHINGTON URBAN DISTRICT COUNCIL. Tenders by April 17.

Gasholder, Tank, and Liquor Tanks.

ASHINGTON URBAN DISTRICT COUNCIL. Tenders by April 17.

Mains, Governors, Valves, &c, for High and Low Pressure.

ASHINGTON URBAN DISTRICT COUNCIL. Tenders by April 17.

Meters (Station, Ordinary, and Prepayment).

ASHINGTON URBAN DISTRICT COUNCIL. Tenders by April 17.

Sulphate Plant.

ASHINGTON URBAN DISTRICT COUNCIL. Tenders by April 17.

Tar-Extractors, &c.

ASHINGTON URBAN DISTRICT COUNCIL. Tenders by April 17.
HARROGATE GAS COMPANY. Tenders by April 9.

Weighbridge.

ASHINGTON URBAN DISTRICT COUNCIL. Tenders by April 17.

OXIDE OF IRON.

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L. MURRAY, Manager.
Gas-Works, Blaina,
Mon., March 20, 1915.